4.0 SOURCES AND TYPES OF RELEASES, OFF-SITE TRANSFERS, AND ON-SITE WASTE MANAGEMENT ACTIVITIES

This section provides an overview of the sources of releases, off-site transfers for further waste management, and on-site waste management activities as well as the release types that were both claimed and observed at each facility visited during the site surveys. Statistically weighted percentages of data are presented to show the distribution of release sources and release types within each SIC Code (see Section 2 for a discussion of statistical weighting). Additionally, percentages of incorrectly reported data and overlooked data are presented. Trends and corresponding discussions regarding observations made during the site visits are presented, as applicable.

For the purposes of this report, "sources" are defined as the streams or units that generate the release, off-site transfer, or on-site waste management activity (such as process vents, container residue, or spills) and "release types" are defined as the environmental media corresponding to elements in Sections 5 through 7 of the Form R (such as releases to fugitive air, releases to stack air, releases to water, releases to land, and transfers to off site disposal). In most cases, data has been presented both in a tabular form for quantitative analysis and in a graphical format for qualitative trend analyses.

Data is presented for RY 1994 and RY 1995. A trend analysis has been conducted whenever applicable between the six SIC Codes visited for RY 1994 and RY 1995.

4.1 Observed On-Site Releases, Off-Site Transfers, and On-Site Waste Management Activities

Table 4-1 presents the distribution (weighted) of sources and the corresponding release type, off-site transfer, or on-site waste management activity that was observed during the site visits for each SIC Code. It also lists a "total" row for each of these activities. This represents the number of facilities that reported at least one release or other waste management activity from any source to that activity or release type. Figure 4-1a presents the "total" by release type or other waste management activity and Figure 4-1b through 4-1h present the data

Table 4-1

Distribution of Release Sources and Off-Site Waste Management Activities
RY 1994 and RY 1995

Release or Waste Management Activity Type	Source	Percent of Facilities Documenting Releases or Waste Management Activity (weighted)					
		SIC Code 25	SIC Code 281	SIC Code 285	SIC Code 30	SIC Code 26	SIC Code 286
Fugitive	Volatilization from Process Areas	76.0%	81.8%	100.0%	63.4%	70.0%	80.0%
	Pumps/Valves/Flanges	43.0%	70.7%	50.1%	23.3%	30.0%	60.0%
	Storage Tank/Stock Pile Losses	14.5%	30.5%	53.1%	14.4%	30.0%	10.0%
	Housekeeping Practices/Clean-up Wastes	29.0%	20.0%	22.5%	8.8%	0.0%	30.0%
	Accidental Spills/Releases	0.0%	44.3%	22.5%	0.0%	10.0%	10.0%
	Process Vents	0.0%	23.4%	12.9%	0.0%	0.0%	0.0%
	Volatilization from Treatment Areas	0.0%	39.2%	8.2%	0.0%	80.0%	30.0%
	Container Residue	0.0%	5.5%	0.0%	0.0%	0.0%	0.0%
	Other[2]	0.0%	7.6%	0.0%	0.0%	0.0%	0.0%
	TOTAL: Reporting from at Least One Source[1]:	**92.8%**	**100.0%**	**100.0%**	**67.4%**	**90.0%**	**80.0%**
Stack	Volatilization from Process Areas	100.0%	65.7%	29.9%	50.9%	80.0%	70.0%
	Pumps/Valves/Flanges	1.0%	21.7%	0.0%	6.0%	0.0%	10.0%
	Storage Tank/Stock Pile Losses	27.9%	60.0%	57.9%	12.8%	30.0%	60.0%
	Housekeeping Practices/Clean-up Wastes	20.5%	0.0%	14.6%	0.0%	0.0%	10.0%
	Accidental Spills/Releases	4.0%	8.3%	0.0%	0.0%	0.0%	0.0%
	Process Vents	0.0%	71.2%	38.1%	0.0%	0.0%	0.0%
	Volatilization from Treatment Areas	4.0%	5.5%	0.0%	5.4%	30.0%	30.0%

Table 4-1 (Continued)

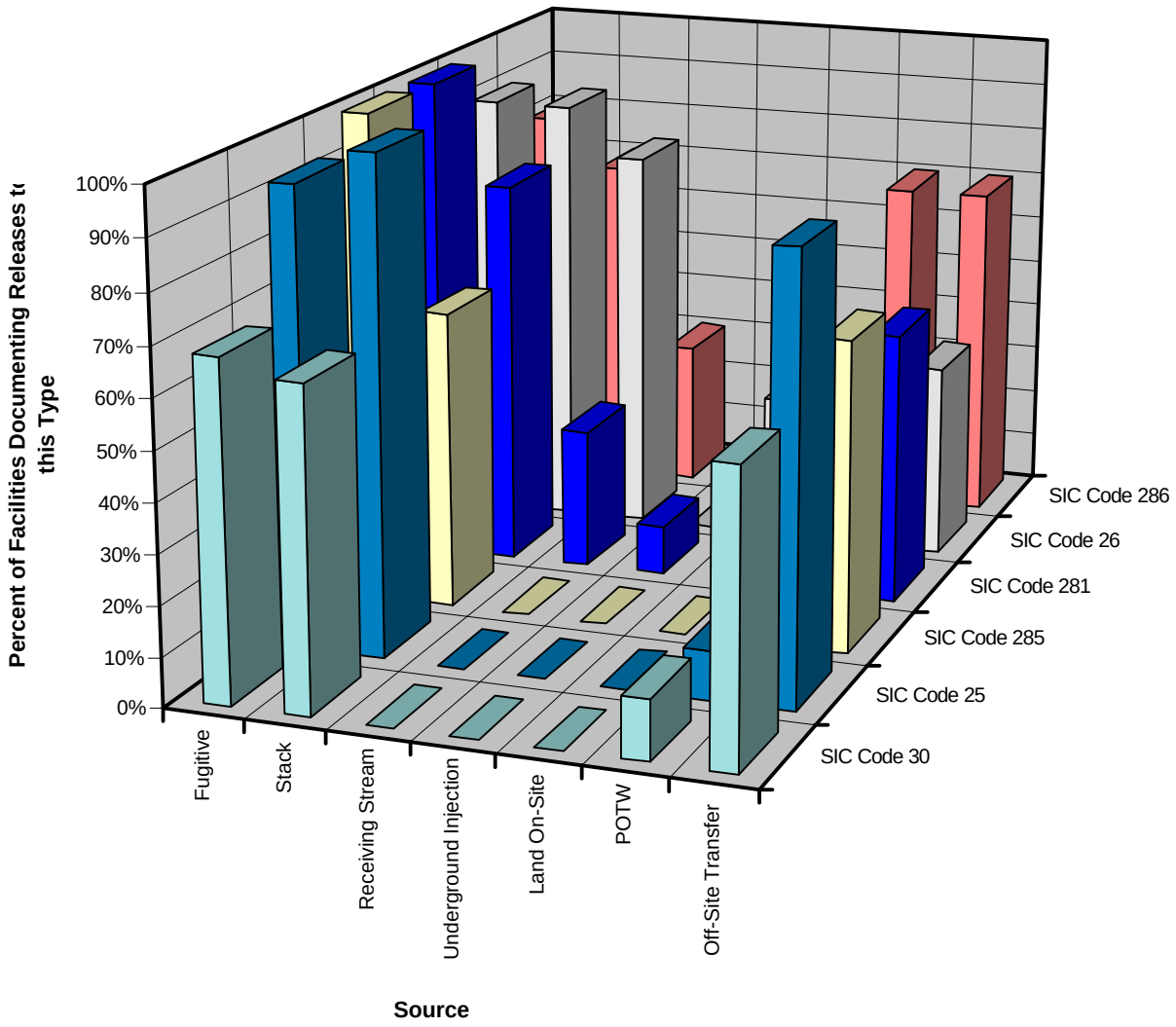
Release or Waste Management Activity Type	Source	Percent of Facilities Documenting Releases or Waste Management Activity (weighted)					
		SIC Code 25	SIC Code 281	SIC Code 285	SIC Code 30	SIC Code 26	SIC Code 286
Stack (Cont.)	Process Discharge Streams	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%
	Combustion By-Products	0.0%	0.0%	0.0%	0.0%	50.0%	10.0%
	Other[2]	0.0%	0.0%	0.0%	6.8%	0.0%	0.0%
	TOTAL: Reporting from at Least One Source[1]:	**100.0%**	**79.6%**	**60.7%**	**64.1%**	**90.0%**	**70.0%**
Receiving Stream	Accidental Spills/Releases	0.0%	7.9%	0.0%	0.0%	0.0%	10.0%
	Waste Treatment Discharge Streams	0.0%	7.9%	0.0%	0.0%	80.0%	10.0%
	Stormwater Runoff	0.0%	21.1%	0.0%	0.0%	20.0%	20.0%
	Process Discharge Streams	0.0%	11.5%	0.0%	0.0%	0.0%	10.0%
	Other[2]	0.0%	0.0%	0.0%	0.0%	0.0%	10.0%
	TOTAL: Reporting from at Least One Source[1]	**0.0%**	**28.8%**	**0.0%**	**0.0%**	**80.0%**	**30.0%**
Underground Injection	Process Discharge Streams	0.0%	10.1%	0.0%	0.0%	0.0%	0.0%
	Other[2]	0.0%	1.7%	0.0%	0.0%	0.0%	0.0%
	TOTAL: Reporting from at Least One Source[1]	**0.0%**	**10.1%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Land On-Site	Accidental Spills/Releases	0.0%	5.3%	0.0%	0.0%	0.0%	0.0%
	Container Residue	0.0%	0.0%	0.0%	0.0%	0.0%	10.0%
	Treatment Sludges, Recycling or Energy Recovery By-Product	0.0%	0.0%	0.0%	0.0%	30.0%	0.0%
	TOTAL: Reporting from at Least One Source[1]	**0.0%**	**5.3%**	**0.0%**	**0.0%**	**30.0%**	**10.0%**

Table 4-1 (Continued)

Release or Waste Management Activity Type	Source	Percent of Facilities Documenting Releases or Waste Management Activity (weighted)					
		SIC Code 25	SIC Code 281	SIC Code 285	SIC Code 30	SIC Code 26	SIC Code 286
POTW	Housekeeping Practices/Clean-up Wastes	0.0%	14.4%	12.4%	9.1%	0.0%	0.0%
	Accidental Spills/Releases	0.0%	11.4%	0.0%	0.0%	0.0%	0.0%
	Waste Treatment Discharge Streams	6.1%	24.4%	20.6%	0.0%	10.0%	50.0%
	Stormwater Runoff	0.0%	10.2%	0.0%	0.0%	0.0%	0.0%
	Process Discharge Streams	9.8%	14.4%	12.4%	9.1%	0.0%	30.0%
	TOTAL: Reporting from at Least One Source[1]:	**9.8%**	**24.4%**	**20.6%**	**12.0%**	**10.0%**	**70.0%**
Off-Site Transfer	Housekeeping Practices/Clean-up Wastes	75.6%	31.9%	38.0%	38.6%	0.0%	20.0%
	Accidental Spills/Releases	0.0%	12.0%	0.0%	18.5%	0.0%	0.0%
	Waste Treatment Discharge Streams	0.0%	20.0%	0.0%	0.0%	30.0%	30.0%
	Process Discharge Streams	33.9%	28.1%	0.0%	28.3%	0.0%	60.0%
	Container Residue	30.9%	15.3%	43.3%	27.4%	0.0%	10.0%
	Treatment Sludges, Recycling or Energy Recovery By-Product	16.1%	9.2%	31.1%	6.7%	40.0%	30.0%
	Combustion By-Products	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%
	Other[2]	1.4%	7.5%	6.6%	29.0%	10.0%	10.0%
	TOTAL: Reporting from at Least One Source[1]:	**88.7%**	**55.5%**	**63.1%**	**57.5%**	**40.0%**	**70.0%**

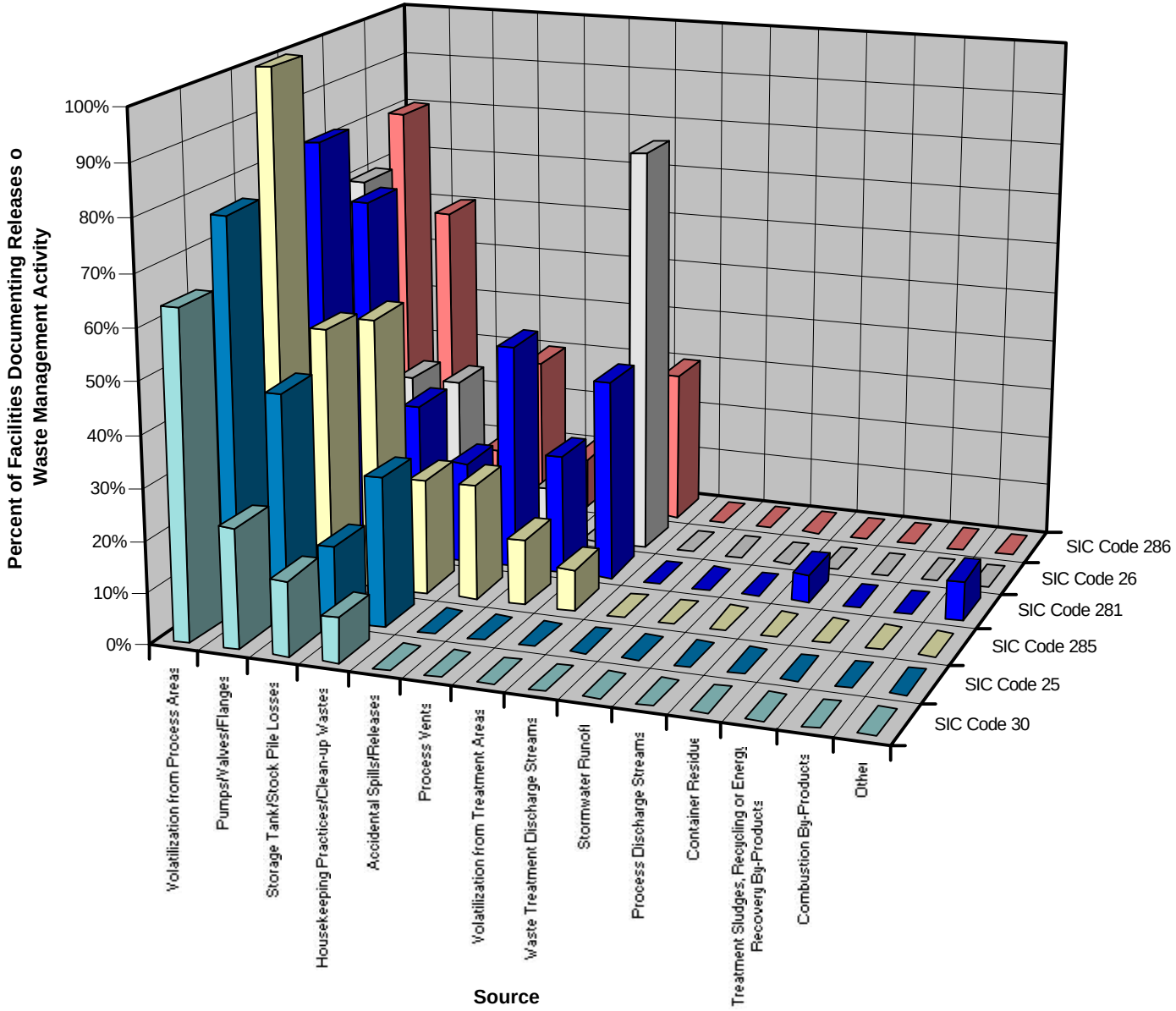
[1]Total is not additive as facilities may report a release type from multiple sources.
[2]Source listed as "other" include: off-spec product, uniform laundering, baghouse dust, cooling system wastewater, tank heel, sampling residue, and injection well treatment.

Figure 4-1a. Distribution to Release Type or Other Waste Management Activity, RY 1994 and RY 1995



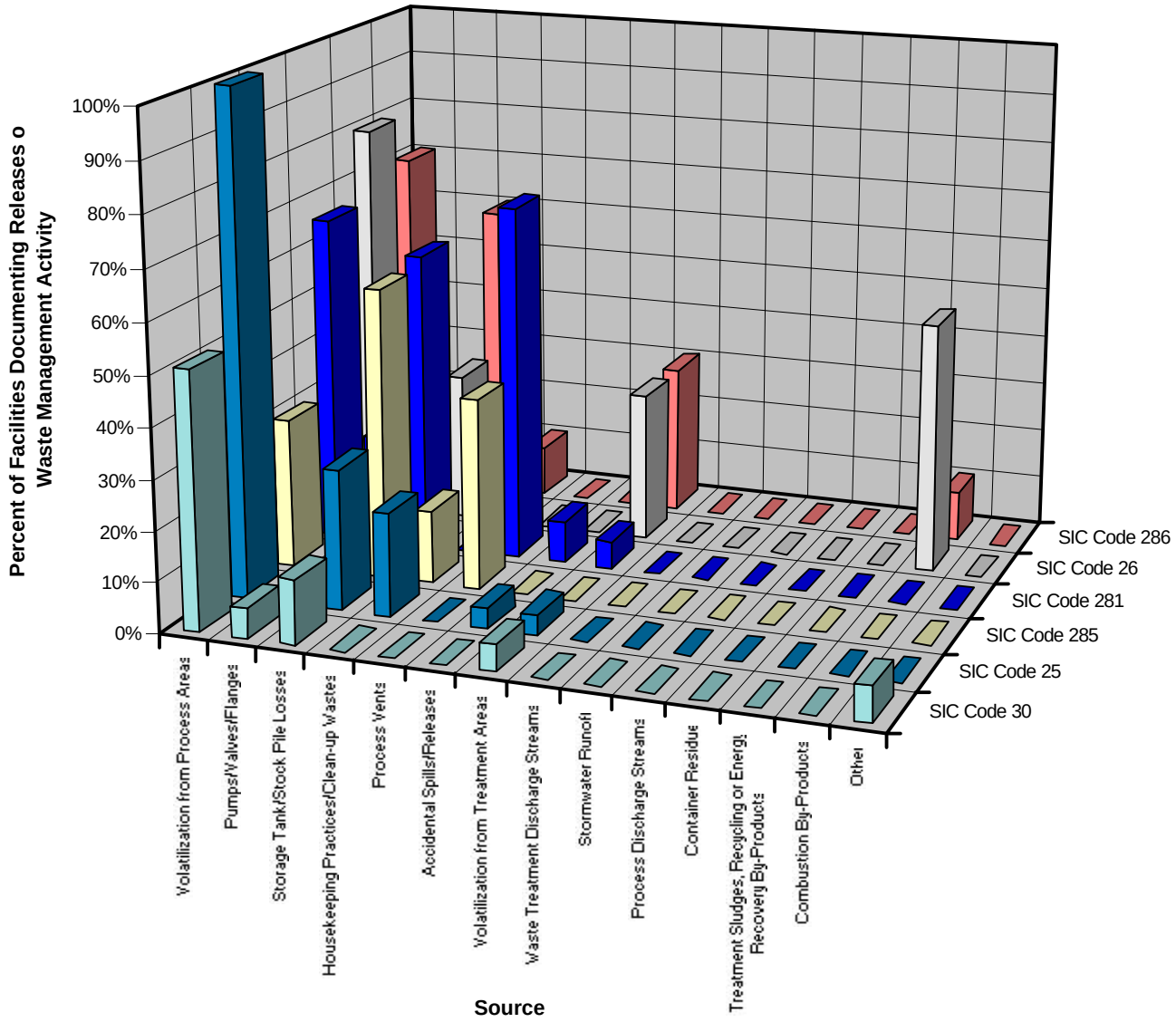
Data for this figure can be found on Table 4-1.

Figure 4-1b. Distribution to Sources for Fugitive Releases
RY 1994 and RY 1995



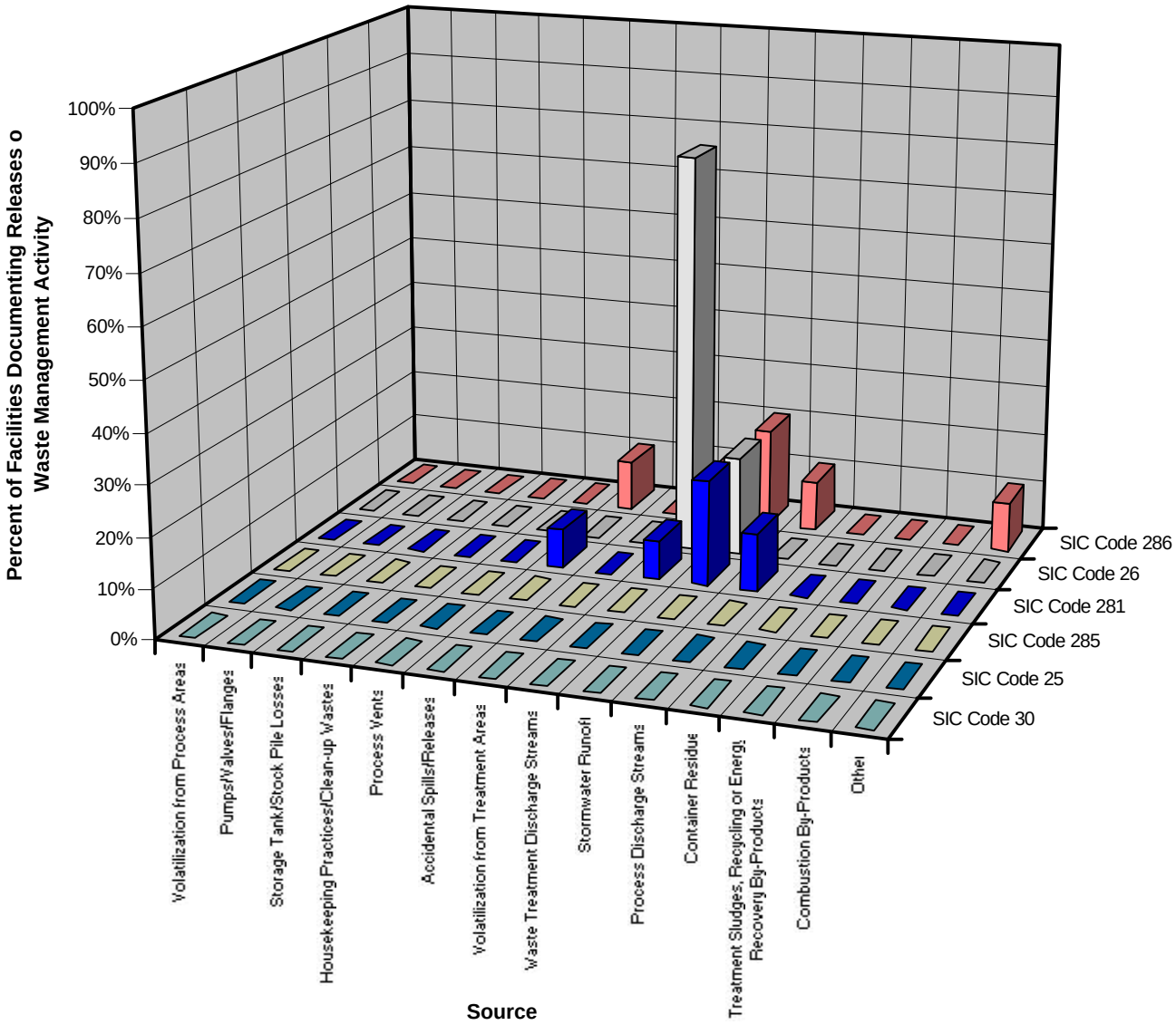
Data for this figure can be found on Table 4-1.

Figure 4-1c. Distribution to Sources for Stack Releases
RY 1994 and RY 1995



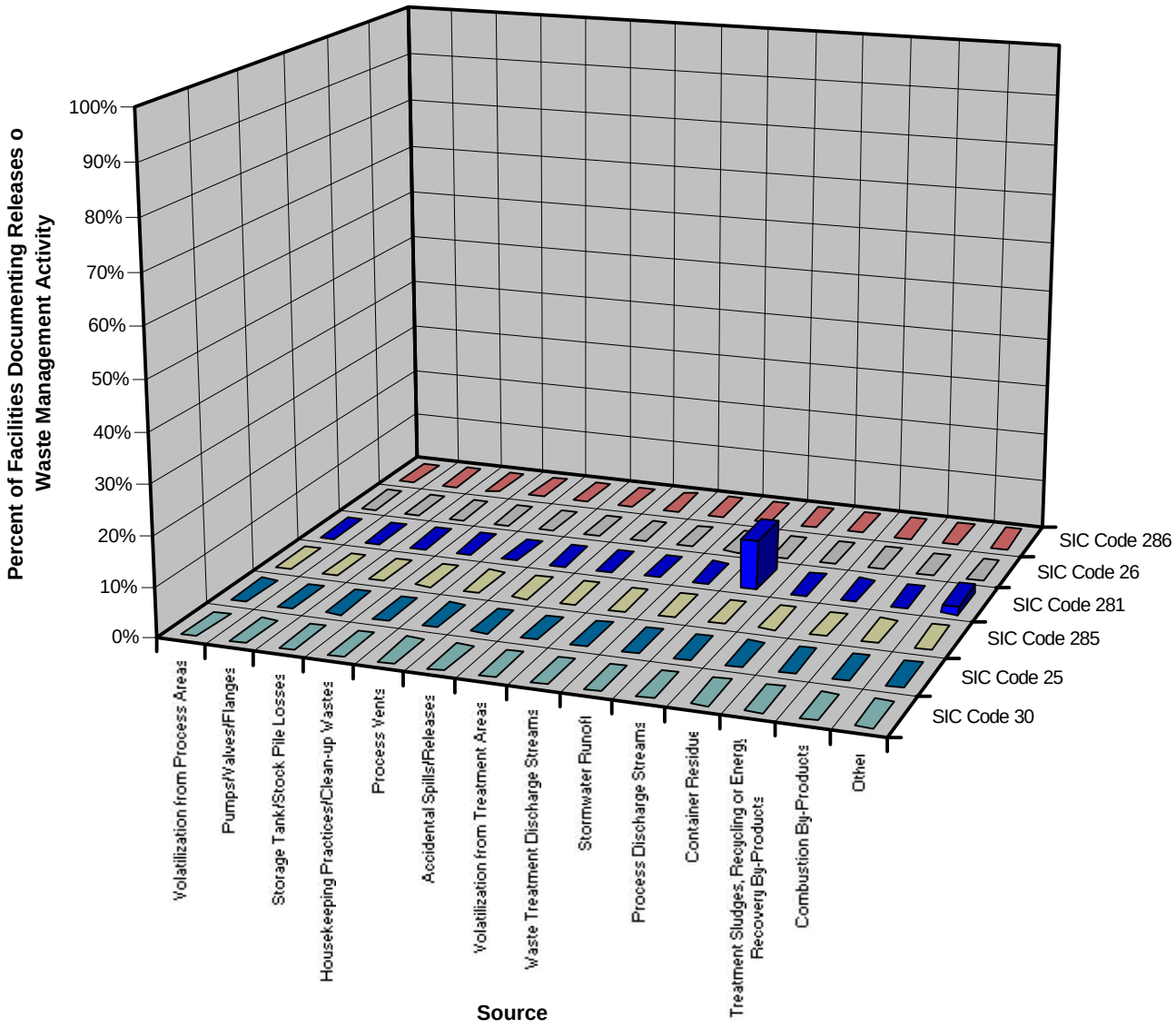
Data for this figure can be found on Table 4-1.

Figure 4-1d. Distribution to Sources for Receiving Stream Releases RY 1994 and RY 1995



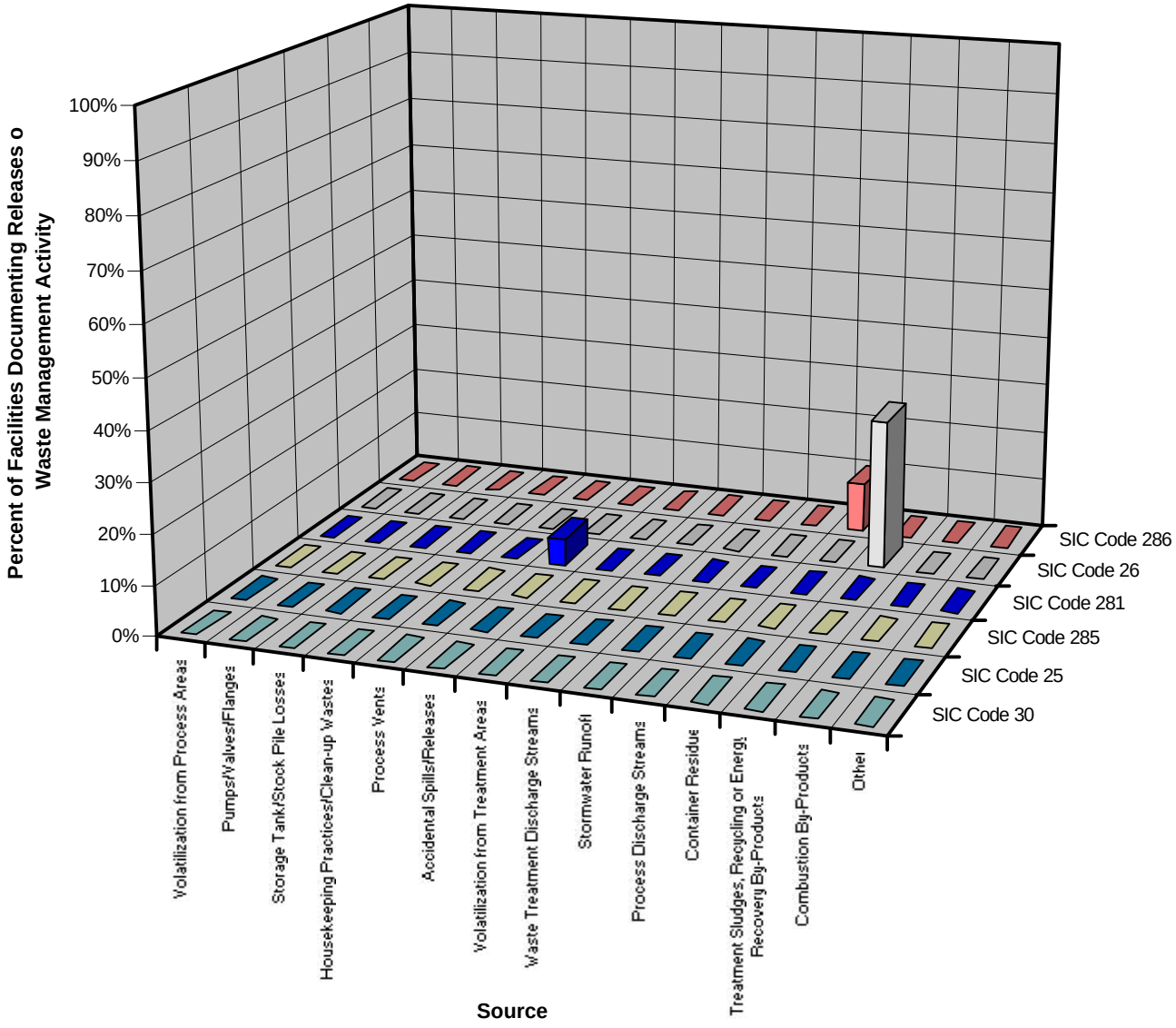
Data for this figure can be found on Table 4-1.

Figure 4-1e. Distribution of Sources for Underground Injection
RY 1994 and RY 1995



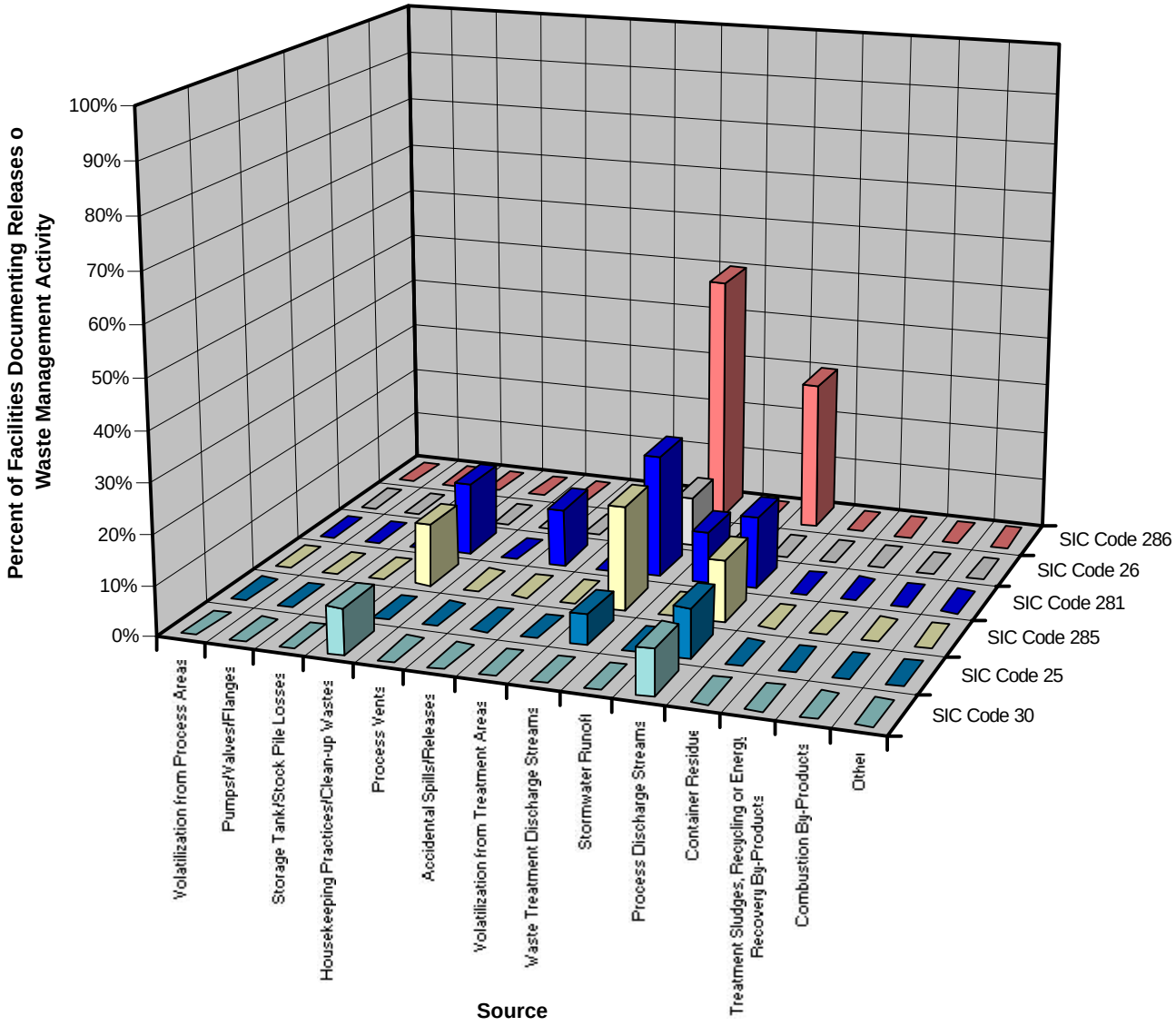
Data for this figure can be found on Table 4-1.

Figure 4-1f. Distribution of Sources for Land On-Site
RY 1994 and RY 1995



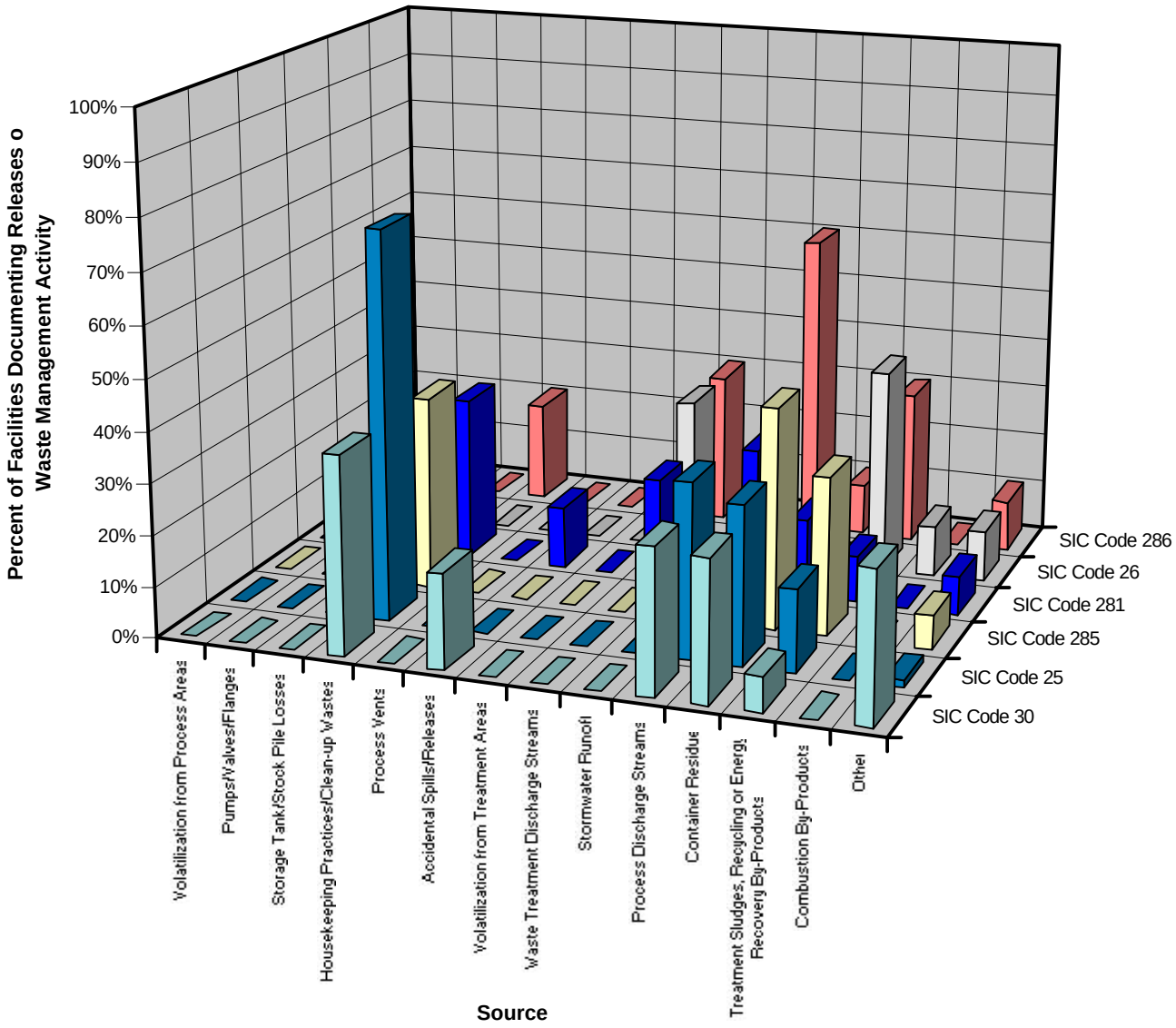
Data for this figure can be found on Table 4-1.

Figure 4-1g. Distribution of Sources for POTW Transfers
RY 1994 and RY 1995



Data for this figure can be found on Table 4-1.

Figure 4-1h. Distribution of Sources for Off-Site Transfer
RY 1994 and RY 1995



Data for this figure can be found on Table 4-1.

graphically by release type or other waste management activity for each source. Table 4-2 presents the percentage of occurrences (weighted) in which facilities incorrectly identified the release type or other waste management activity. Figure 4-2 presents the data graphically. Table 4-3 presents the percentage of occurrences (weighted) in which various release and other waste management sources were overlooked by facilities. Figure 4-3 presents the data graphically.

In general, most facilities in each SIC Code reported fugitive and stack releases and some type of transfer off-site for further waste management. Many facilities also reported transfers to POTWs. Other release types and waste management activities including those to on-site land were rarely observed.

4.2 Incorrectly Reported On-Site Release, Off-Site Transfer, and On-Site Waste Management Activity Types

A comparison of the on-site releases, off-site transfers, and on-site waste management activities reported by facilities and those identified by site surveyors showed that a large number of on-site releases, off-site transfers, and on-site waste management activities were reported to the wrong release or waste management activity type. This section discusses those types that were incorrectly reported and presents a qualitative discussion regarding the corresponding error in release and other waste management activity estimates. A detailed discussion of these quantities is presented in Section 5. Table 4-2 presents the weighted percent of reports that had release or other waste management activity types that were incorrectly identified.

In many circumstances, the overall estimates that were reported were correct, but they were assigned to the wrong type. For example, it was observed that many paint manufacturing facilities (SIC Code 285) correctly identified, and accurately estimated, air releases. However, the releases were incorrectly reported as stack releases (Section 5.2 of Form R) rather than as fugitive releases (Section 5.1). The main source of this error is that state reporting requirements and other federal reporting requirements often differ on the definition of stack vs. fugitive emissions, causing confusion for facilities. In some instances general room air that is channeled to one vent on the building roof is considered a stack release, regardless of

whether there is an associated air pollution control device (APCD). This is considered a fugitive release in other circumstances. This caused confusion when facilities completed various reporting requirements because they did not want to claim a release as a fugitive for one report and as a stack for another. This source of error was more common at facilities that had fugitive releases from indoor process areas without sophisticated air pollution control systems. Per TRI guidance, the use of an APCD makes this type of release a stack emission, which coincides with the definition of stack releases from most state requirements; thereby eliminating this source of error. While some facilities in each SIC Code incorrectly reported stack emissions, paint manufacturers (SIC Code 285) were the most likely to have this type of process (and corresponding error), and this type of error was rarely observed for furniture manufacturing (SIC Code 25) because typical facilities employed APCDs on building vents.

Table 4-2 and Figure 4-2 also show that many facilities (in most SIC Codes) incorrectly identified transfers off-site for further waste management (off-site recycling, off-site disposal, off-site energy recovery, and off-site treatment). Again, it was observed that the transfers were often correctly identified and estimated, but the reported disposition was incorrect. One source of this error is that many facilities expressed confusion as to how toxic chemical waste sent off-site should be classified. Many facilities did not investigate the ultimate disposition of the toxic chemical waste (nor felt it was their responsibility to do so). They simply guessed as to whether the waste would be treated, recycled, or disposed. This error was not typically observed at facilities that sent waste solvents off-site for energy recovery. This may be due to the fact that waste solvents are often sent off-site in large quantities (requiring large fees) and the receiving companies rigorously test, track, and charge by the quantity received.

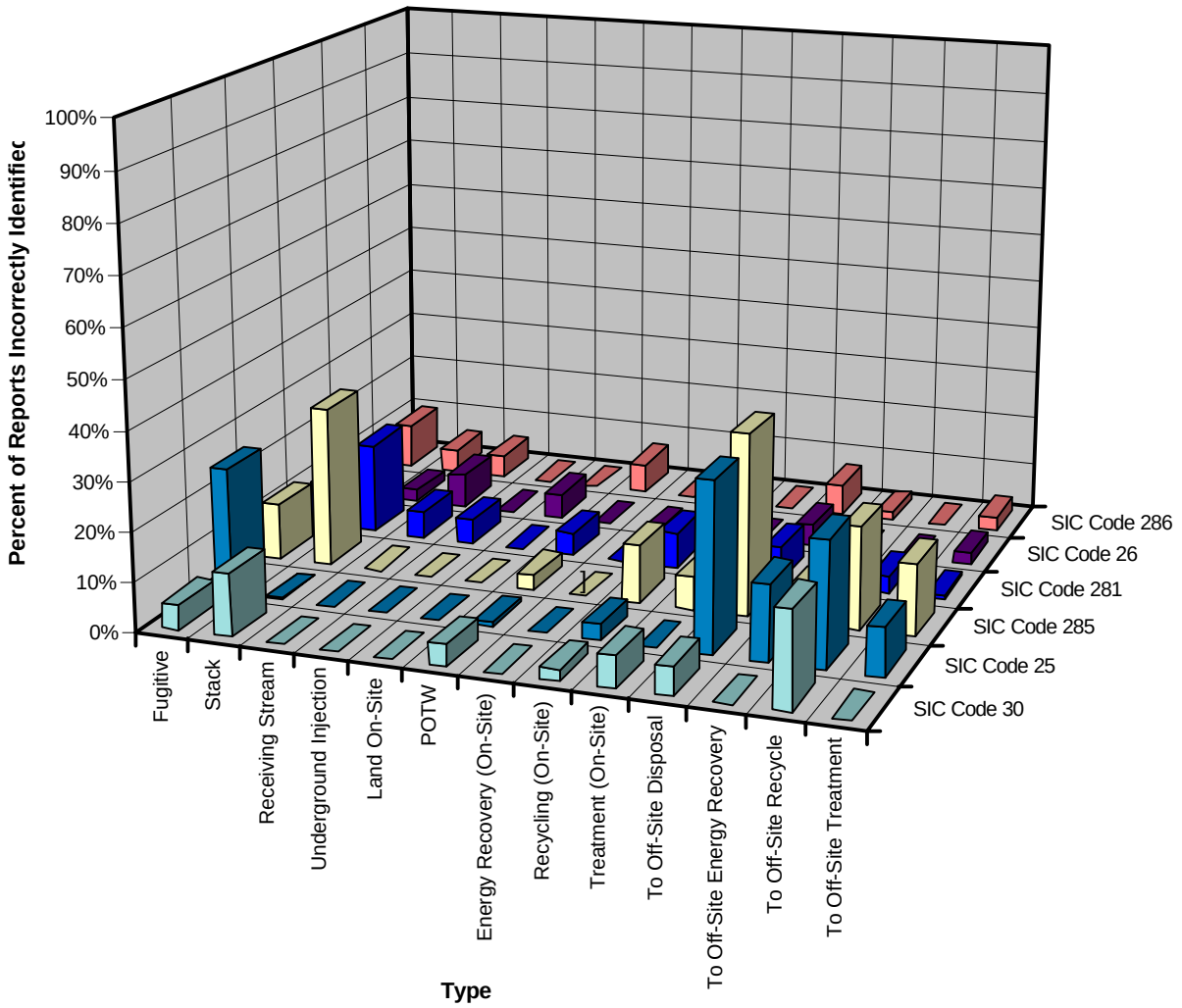
There were significant quantities of transfers to POTWs. However, these transfers were typically identified correctly by facilities (although the estimated quantity transferred may have been in error). This was expected because there are typically federal, state, and local limits on the water discharged to POTWs, and most POTWs require discharge monitoring. Therefore, facilities were aware of these discharges and had already invested time and effort to determine their quantity and source.

Table 4-2

Incorrectly Identified On-Site Releases, Off-Site Transfers, or On-Site Waste Management Activity Types, RY 1994 and RY 1995

Release or Waste Management Activity Type	Percent of Reports Identified (weighted)					
	SIC Code 25	SIC Code 281	SIC Code 285	SIC Code 30	SIC Code 26	SIC Code 286
Fugitive	25.7%	9.0%	11.4%	5.2%	9.0%	9.4%
Stack	0.3%	18.6%	32.8%	12.8%	2.3%	4.7%
Receiving Stream	0.0%	5.5%	0.0%	0.0%	6.8%	4.7%
Underground Injection	0.0%	5.1%	0.0%	0.0%	0.0%	0.0%
Land On-Site	0.0%	0.0%	0.0%	0.0%	4.9%	0.0%
POTW	0.9%	4.7%	3.1%	4.2%	0.0%	6.3%
Recycling (On-Site)	3.3%	7.3%	11.8%	2.3%	0.0%	0.0%
Treatment (On-Site)	0.0%	0.5%	6.6%	6.5%	0.0%	0.0%
To Off-Site Disposal	34.4%	6.9%	36.9%	5.9%	4.5%	6.5%
To Off-Site Energy Recovery	15.4%	1.1%	6.5%	0.0%	0.0%	1.6%
To Off-Site Recycle	25.4%	3.5%	20.7%	19.7%	0.0%	0.0%
To Off-Site Treatment	9.8%	0.8%	14.6%	0.0%	2.3%	3.2%

Figure 4-2. Incorrectly Identified Release Types and Other Waste Management Activities RY 1994 and RY 1995



Data for this figure can be found in Table 4-2.

Releases to receiving streams, underground injection wells, on-site land and on-site energy recovery were rarely observed during the site visits. Therefore, the potential for incorrectly identifying releases or on-site energy recovery was low or non-existent.

4.3 Overlooked Releases and Other Waste Management Activities

As shown on Table 4-3 and Figure 4-3, several facilities overlooked some releases and other waste management activities entirely. In some cases this resulted in an underestimation of the overall quantity of the toxic chemical managed as waste by the facility. However, in cases where a mass balance was used as the method to determine the quantity of the toxic chemical managed as waste, the facility may have included the quantity that was overlooked in another release type. For example, a facility may have overlooked a release or transfer off-site from container residual. However, after conducting a material balance and analyzing the total throughput and quantifiable releases and other waste management activities, this quantity may have been unaccounted for. The facility may have assumed this quantity was released from process areas as fugitive emissions. In this case, the release or transfer off-site to one type would have been under reported, while the fugitive air emissions would have been over reported.

It was observed that the primary overlooked sources were from chemicals sent off-site as container residue (typically as liquid residue in “empty” drums), stack emissions of volatile chemicals from on-site storage tanks, liquid discharges to POTWs or receiving streams (from aqueous washwater and spent solvents from waste cleaning materials), and fugitive releases from process areas and process lines (pumps, valves, and flanges).

The largest source of overlooked releases and other waste management activities (both frequency and overall quantity) was from container residue. Although the EPCRA Section 313 instructions specify that container residue should be considered as a release, most facilities assumed that all used drums, totes, or small containers were completely empty and the subsequent transfer of the empty containers off site (or the disposal on site) did not result in any release or transfer of EPCRA Section 313 chemicals. Many facilities did not consider the potential for reportable quantities of residual chemicals in these containers. Other facilities

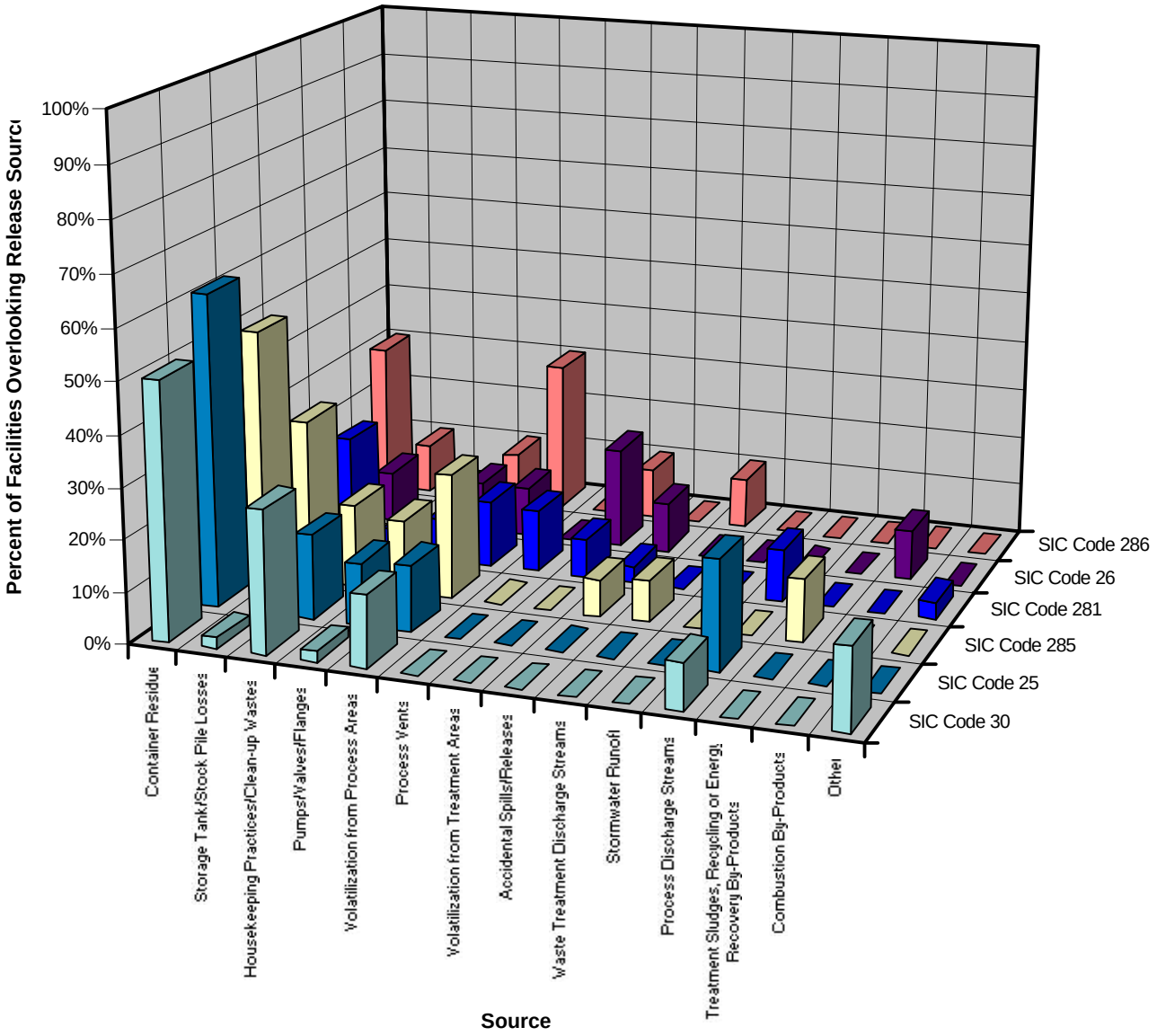
Table 4-3

Overlooked Release and Other Waste Management Activity Sources
RY 1994 and RY 1995

Source	Percent of Reports Identified (weighted)					
	SIC Code 25	SIC Code 281	SIC Code 285	SIC Code 30	SIC Code 26	SIC Code 286
Container Residue	61.4%	17.7%	49.0%	50.3%	10.0%	30.0%
Storage Tank/Stock Pile Losses	0.0%	22.9%	32.1%	2.1%	10.0%	10.0%
Housekeeping Practices/Clean-up Wastes	16.6%	5.3%	16.3%	27.9%	0.0%	0.0%
Pumps/Valves/Flanges	12.2%	8.6%	14.3%	2.1%	10.0%	10.0%
Volatilization from Process Areas	12.9%	13.0%	24.5%	14.0%	10.0%	30.0%
Process Vents	0.0%	12.3%	0.0%	0.0%	0.0%	0.0%
Volatilization from Treatment Areas	0.0%	7.5%	0.0%	0.0%	20.0%	10.0%
Accidental Spills/Releases	0.0%	3.4%	7.2%	0.0%	10.0%	0.0%
Waste Treatment Discharge Streams	0.0%	0.0%	8.2%	0.0%	0.0%	10.0%
Process Discharge Streams	21.5%	10.1%	0.0%	9.1%	0.0%	0.0%
Treatment Sludges, Recycling or Energy Recovery By-Products	0.0%	0.0%	12.3%	0.0%	0.0%	0.0%
Combustion By-Products	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%
Other[1]	0.0%	3.4%	0.0%	15.9%	0.0%	0.0%

[1]Source of “other” include: baghouse dust and repackaging losses.

Figure 4-3. Overlooked Releases and Other Waste Management Activity Sources RY 1994 and RY 1995



Data for this figure can be found on Table 4-3.

considered this potential release or waste management quantity but felt it was negligible (and did not report it) if drums were shipped as “empty”, as defined by federal and/or state shipping regulations.

In practice, liquids are often removed from drums by gravity draining or by pumping. Neither of these methods removes all material from the drum and an appreciable quantity may remain. Additionally, some Department of Transportation (DOT) and RCRA Regulations require special handling precautions when transporting drums containing hazardous materials. Drums that once contained these materials that have been emptied may be exempt from these regulations. The definition can vary, but drums are often defined as empty for shipping purposes if they contain less than two inches of a liquid substance. Therefore, facilities often empty drums to comply with these regulations, but they do not completely empty them, due to economical considerations. It should be noted that many facilities sent hundreds of “empty” drums off-site and that if each drum contained some residual chemical, a significant quantity of release and otherwise managed was overlooked. Additionally, many facilities overlooked releases and other waste management quantities due to residual powdered EPCRA Section 313 chemicals in empty bags.

Most of the liquid releases and other waste management quantities from overlooked container residue should have been reported as off-site transfers to a disposal facility. However, some should have been reported to off-site recycling, off-site treatment, or off-site energy recovery. Other overlooked liquid discharges should have been reported to either POTWs or to receiving streams because the drums were rinsed on site and the rinsewater was collected and disposed to the local POTW or receiving stream. Most overlooked solid releases from bag residue should have been reported as being disposed to on-site landfills or to off-site disposal.

Volatilization from treatment areas was rarely overlooked. This is presumably because most treatment chemicals are either non-volatile or are completely destroyed during the treatment process.

Accidental spills and releases were also rarely overlooked. However, a number of facilities questioned the definition of a spill and requested additional guidance. The primary points

of confusion pertained to the quantity and frequency of occurrence of spills. For example, it is common that paint manufacturing facilities have "spills" of paints containing EPCRA Section 313 chemicals or solvents used to make the paints on a daily basis. These "spills" are typically collected and sent to disposal, or the EPCRA Section 313 chemical was assumed to be volatilized and lost as a fugitive emission. Most facilities did not claim this as a catastrophic release in Section 8.8. However, they were unsure how to estimate the quantity and how to report it. Additionally, these "spills" are typically small (drippings that are less than one liter per occurrence). However, occasionally a pail, barrel, or drum may be knocked over. In these cases, facilities have asked for guidance as to when this should be reported as a catastrophic release rather than a "typical" release from the process.

Site surveyors did not identify any overlooked releases or other waste management activities from combustion by-products at facilities in SIC Codes 25, 281, 285, or 30. This can be attributed to the fact that very few of these facilities utilized on-site boilers, industrial furnaces, or incinerators. Those that did (typically chemical facilities or furniture manufacturers) used clean fuels (such as natural gas) that generated quantities of EPCRA Section 313 chemicals that were below reporting thresholds. However, some facilities in SIC Codes 26 and 286 that used coal and/or fuel oil for on-site boilers overlooked the incidental manufacture of EPCRA Section 313 chemicals from these units.

The pulp and paper industry often uses on-site boilers or recovery furnaces for the destruction of unwanted byproducts and the concurrent generation of steam for use in the manufacturing process. Coal and/or fuel oil are typical fuels for these units. Combustion of these fuels can result in the coincidental manufacture and subsequent release of EPCRA Section 313 chemicals above the reporting threshold. Some facilities overlooked this potential manufacture and release. EPCRA Section 313 chemicals that were manufactured above the threshold, but overlooked included sulfuric acid (acid aerosols) and hydrochloric acid (acid aerosols). Formaldehyde was also manufactured in appreciable quantities, and overlooked, by

some facilities. However, it was not manufactured above the reporting threshold at any sites that were visited. It is expected that facilities in other SIC Codes that utilize large coal or fuel oil burning recovery boilers may have also overlooked this release source.

4.4 Calculation Methodologies

EPA requires facilities to designate one of four categories of calculation methodology that were used for each release or other waste management activity estimate (monitoring data, mass balances, emission factors, and engineering judgment or calculations). Table 4-4 presents the distribution of calculation methodologies that were used (weighted) to determine estimates for each release or other waste management activity type. It was observed during the review of facility notes that facilities often used multiple methods or reported a method that was inconsistent with the method actually used. Therefore, the data reported in Table 4-4 represents the site surveyor's opinion as to the primary method actually used by the facility, not necessarily the method reported on the facility's Form R. This allows for analysis of data accuracy when compared to the actual methods used. Additionally, a significant number of facilities used hazardous waste manifests to calculate estimates of off site transfers. Site surveyors noted these occurrences and their frequency of use is presented along with the four EPA-accepted methods when applicable. Figures 4-4a through 4-4m present the calculation methodology data graphically. There was considerable difference in the methodologies used between each SIC Code and in those used within SIC Codes for each release or other waste management activity type. It should be noted that there were few or no releases reported to several release types. In these circumstances the table and corresponding figures currently show 0%.

Nearly all facilities reported at least one fugitive release. Site surveyors observed that fugitive releases were typically the most difficult for facilities to estimate. Engineering calculations, as presented in Table 4-4 and the corresponding figures, are the predominant method used by most facilities. Site surveyors observed that many facilities actually used one or more of the methods to estimate fugitive emissions, and applied engineering judgement to total the emissions from all sources. This included engineering judgement for partitioning releases between stack and fugitive if monitoring data was not available. Mass balances, monitoring data,

Table 4-4

Distribution of Calculation Methodologies, RY 1994 and RY 1995

Release or Other Waste Management Activity Type	Calculation Methodology	Percent of Facilities Documenting Releases (weighted)					
		SIC Code 25	SIC Code 281	SIC Code 285	SIC Code 30	SIC Code 26	SIC Code 286
Fugitive	Engineering Calculations	26.8%	59.5%	62.4%	38.5%	40.7%	22.6%
	Mass Balance	62.1%	1.6%	8.7%	23.6%	0.0%	9.4%
	Monitoring Data	0.0%	6.8%	0.0%	0.0%	0.0%	15.1%
	Emission Factors	1.8%	30.9%	21.5%	34.5%	51.9%	52.8%
	Other[1]	9.3%	1.2%	7.5%	3.4%	7.4%	0.0%
Stack	Engineering Calculations	19.4%	62.0%	59.7%	52.5%	15.1%	46.3%
	Mass Balance	72.1%	3.3%	11.0%	24.2%	3.0%	0.0%
	Monitoring Data	0.0%	17.8%	9.7%	5.8%	12.1%	11.1%
	Emission Factors	1.7%	11.1%	19.7%	14.1%	69.7%	40.7%
	Other[1]	6.8%	5.7%	0.0%	3.4%	0.0%	1.9%
Receiving Stream	Engineering Calculations	0.0%	18.4%	0.0%	0.0%	36.7%	13.0%
	Mass Balance	0.0%	0.0%	0.0%	0.0%	3.3%	8.7%
	Monitoring Data	0.0%	81.6%	0.0%	0.0%	33.3%	78.3%
	Emission Factors	0.0%	0.0%	0.0%	0.0%	20.0%	0.0%
	Other[1]	0.0%	0.0%	0.0%	0.0%	6.7%	0.0%
Underground Injection	Engineering Calculations	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%
Land On-Site	Engineering Calculations	0.0%	100.0%	0.0%	0.0%	60.0%	100.0%
	Monitoring Data	0.0%	0.0%	0.0%	0.0%	20.0%	0.0%
	Emission Factors	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%

Table 4-4 (Continued)

Distribution of Calculation Methodologies, RY 1994 and RY 1995

Release or Other Waste Management Activity Type	Calculation Methodology	Percent of Facilities Documenting Releases (weighted)					
		SIC Code 25	SIC Code 281	SIC Code 285	SIC Code 30	SIC Code 26	SIC Code 286
Land On-Site (Cont.)	Other[1]	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%
POTW	Engineering Calculations	15.7%	40.8%	100.0%	0.0%	0.0%	26.8%
	Mass Balance	84.3%	37.7%	0.0%	0.0%	0.0%	9.8%
	Monitoring Data	0.0%	21.6%	0.0%	100.0%	100.0%	63.4%
To Off-Site Disposal	Engineering Calculations	0.0%	22.2%	92.3%	47.3%	42.9%	75.0%
	Mass Balance	0.0%	12.1%	6.8%	53.7%	28.6%	0.0%
	Monitoring Data	0.0%	65.7%	0.9%	0.0%	0.0%	25.0%
	Emission Factors	0.0%	0.0%	0.0%	0.0%	14.3%	0.0%
	Other[1]	0.0%	0.0%	0.0%	0.0%	14.3%	0.0%
To Off-Site Treatment	Engineering Calculations	0.0%	21.1%	71.1%	27.2%	0.0%	4.8%
	Mass Balance	0.0%	10.5%	0.0%	33.2%	0.0%	0.0%
	Monitoring Data	87.5%	34.2%	28.9%	39.5%	0.0%	95.2%
	Hazardous Waste Manifests	0.0%	34.2%	0.0%	0.0%	0.0%	0.0%
	Emission Factors	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Other[1]	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%
To Off-Site Recycle	Engineering Calculations	4.9%	0.0%	63.3%	73.3%	0.0%	0.0%
	Monitoring Data	0.0%	100.0%	29.6%	26.7%	0.0%	100.0%
	Hazardous Waste Manifests	92.3%	0.0%	7.1%	0.0%	0.0.%	0.0%

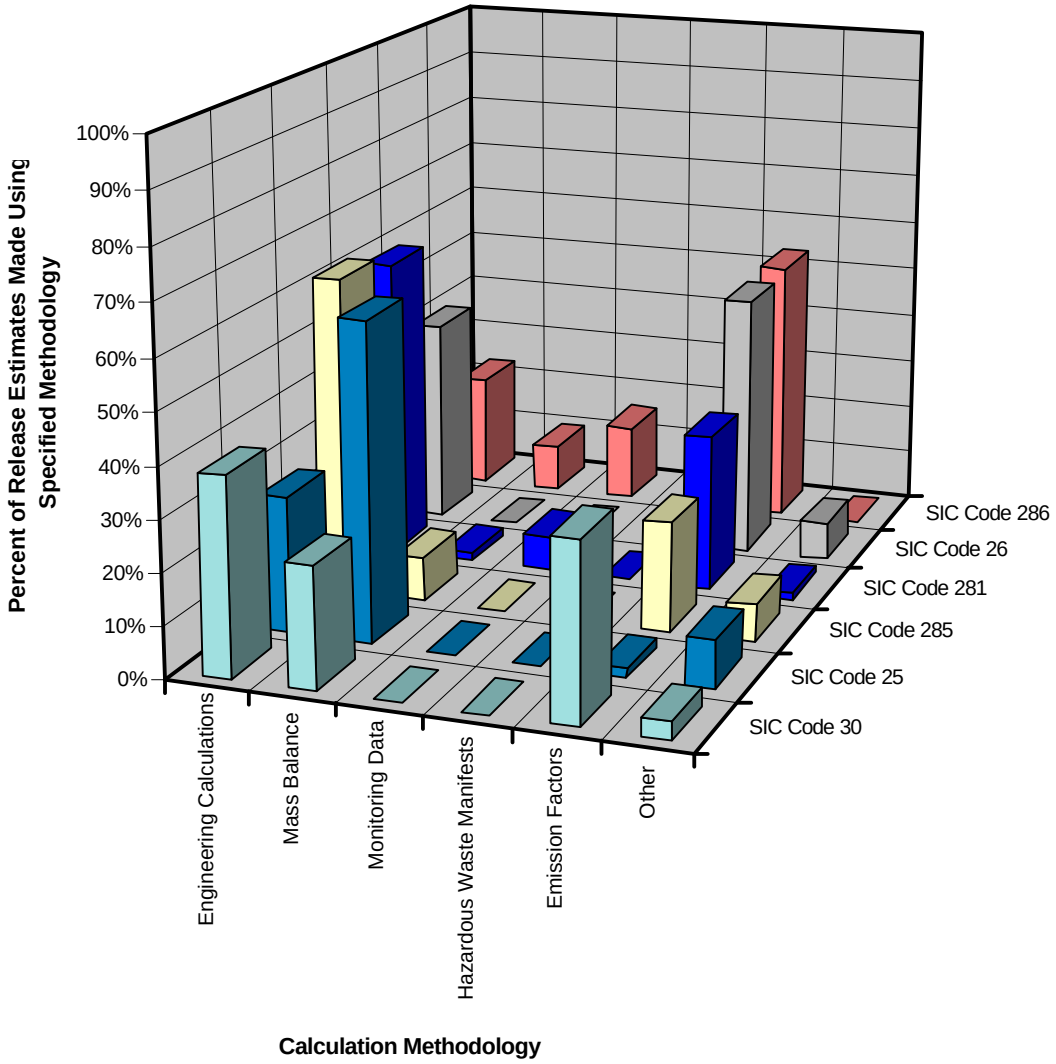
Table 4-4 (Continued)

Distribution of Calculation Methodologies, RY 1994 and RY 1995

Release or Other Waste Management Activity Type	Calculation Methodology	Percent of Facilities Documenting Releases (weighted)					
		SIC Code 25	SIC Code 281	SIC Code 285	SIC Code 30	SIC Code 26	SIC Code 286
To Off-Site Recycle (Cont.)	Other[1]	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%
To Off-Site Energy Recovery	Engineering Calculations	19.9%	71.6%	8.1%	16.7%	0.0%	4.5%
	Mass Balance	13.9%	0.0%	0.0%	0.0%	0.0%	13.6%
	Monitoring Data	31.6%	0.0%	89.8%	0.0%	0.0%	81.8%
	Hazardous Waste Manifests	23.2%	28.4%	2.1%	83.3%	0.0%	0.0%
	Other[1]	11.4%	0.0%	0.0%	0.0%	0.0%	0.0%
On-Site Treatment	Engineering Calculations	0.0%	33.5%	100.0%	20.9%	30.3%	29.4%
	Mass Balance	100.0%	32.8%	0.0%	0.0%	30.3%	5.9%
	Monitoring Data	0.0%	29.0%	0.0%	79.1%	18.2%	64.7%
	Emission Factors	0.0%	4.6%	0.0%	0.0%	21.2%	0.0%
On-Site Energy Recovery	Engineering Calculations	0.0%	0.0%	0.0%	0.0%	42.9%	0.0%
	Mass Balance	0.0%	0.0%	0.0%	0.0%	28.6%	0.0%
	Monitoring Data	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	Emission Factors	0.0%	0.0%	0.0%	0.0%	28.6%	0.0%
On-Site Recycling	Engineering Calculations	18.2%	47.5%	48.7%	92.0%	100.0%	71.4%
	Mass Balance	3.2%	0.0%	21.1%	0.0%	0.0%	0.0%
	Monitoring Data	33.2%	52.5%	26.5%	8.0%	0.0%	28.6%
	Other[1]	45.3%	20.5%	3.6%	0.0%	0.0%	0.0%

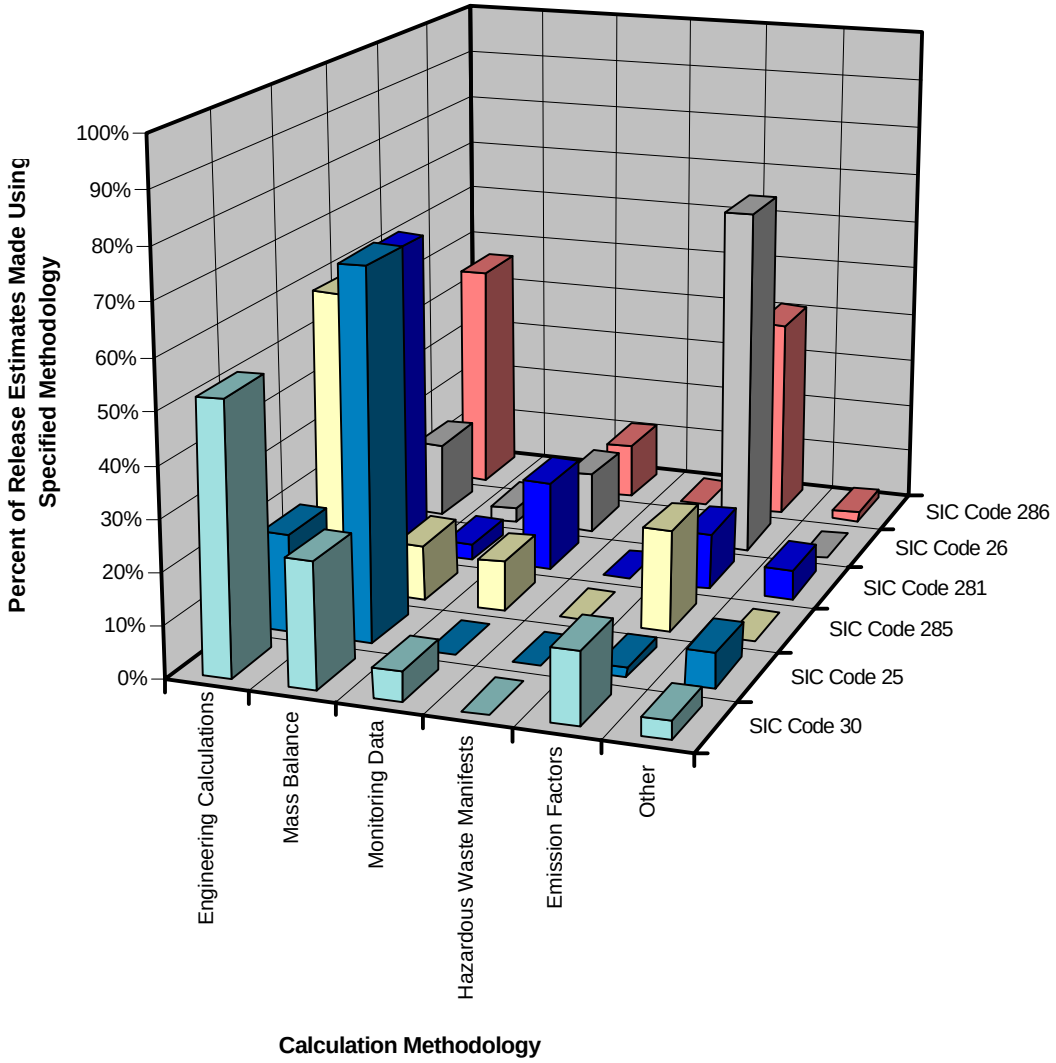
[1]"Other" methodologies according to facility notes include: hazardous waste manifests, off-site facility test reports, facility or trade association computer modeling, air permit limits, and "undocumented".

Figure 4-4a. Distribution of Calculation Methodologies (Fugitive)
RY 1994 and RY 1995



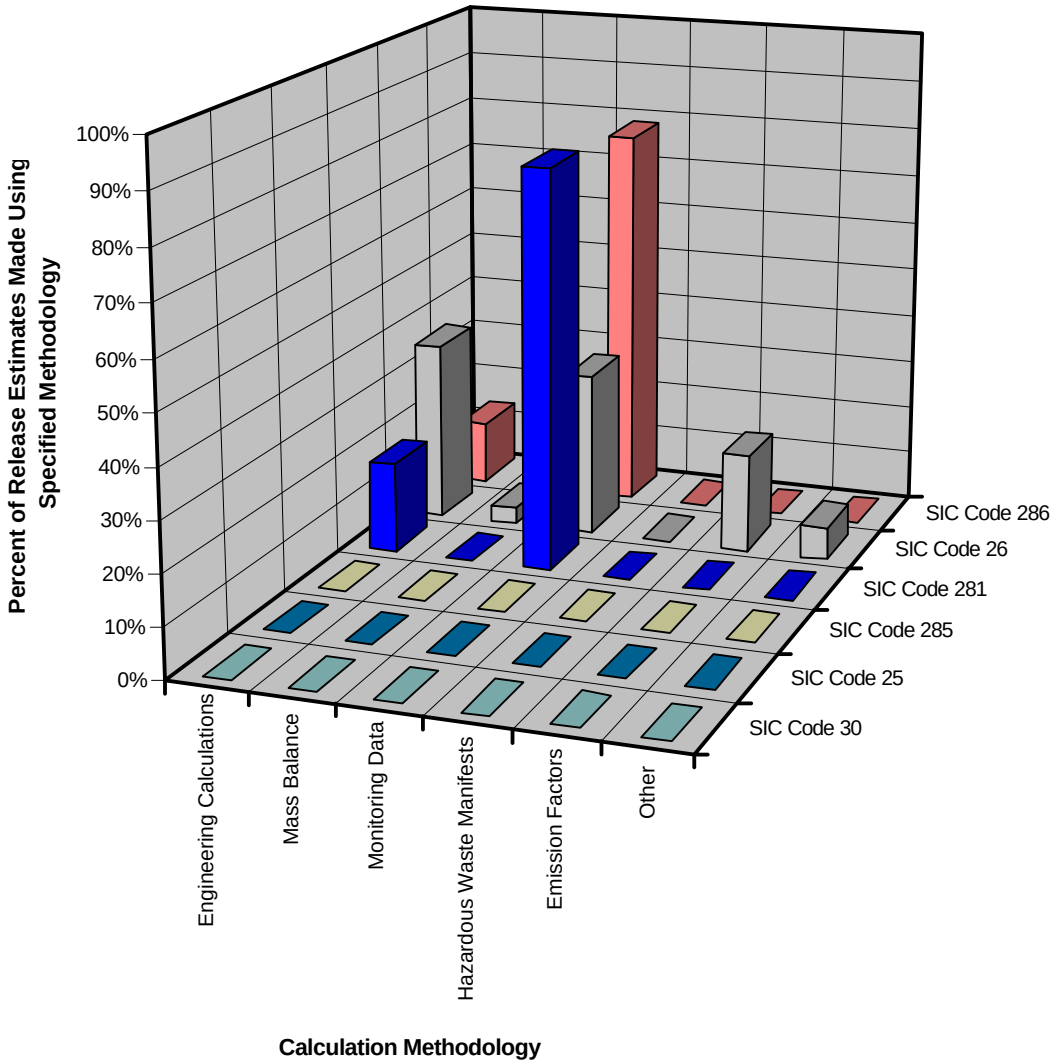
Data for this figure can be found on Table 4-4.

Figure 4-4b. Distribution of Calculation Methodologies (Stack)
RY 1994 and RY 1995



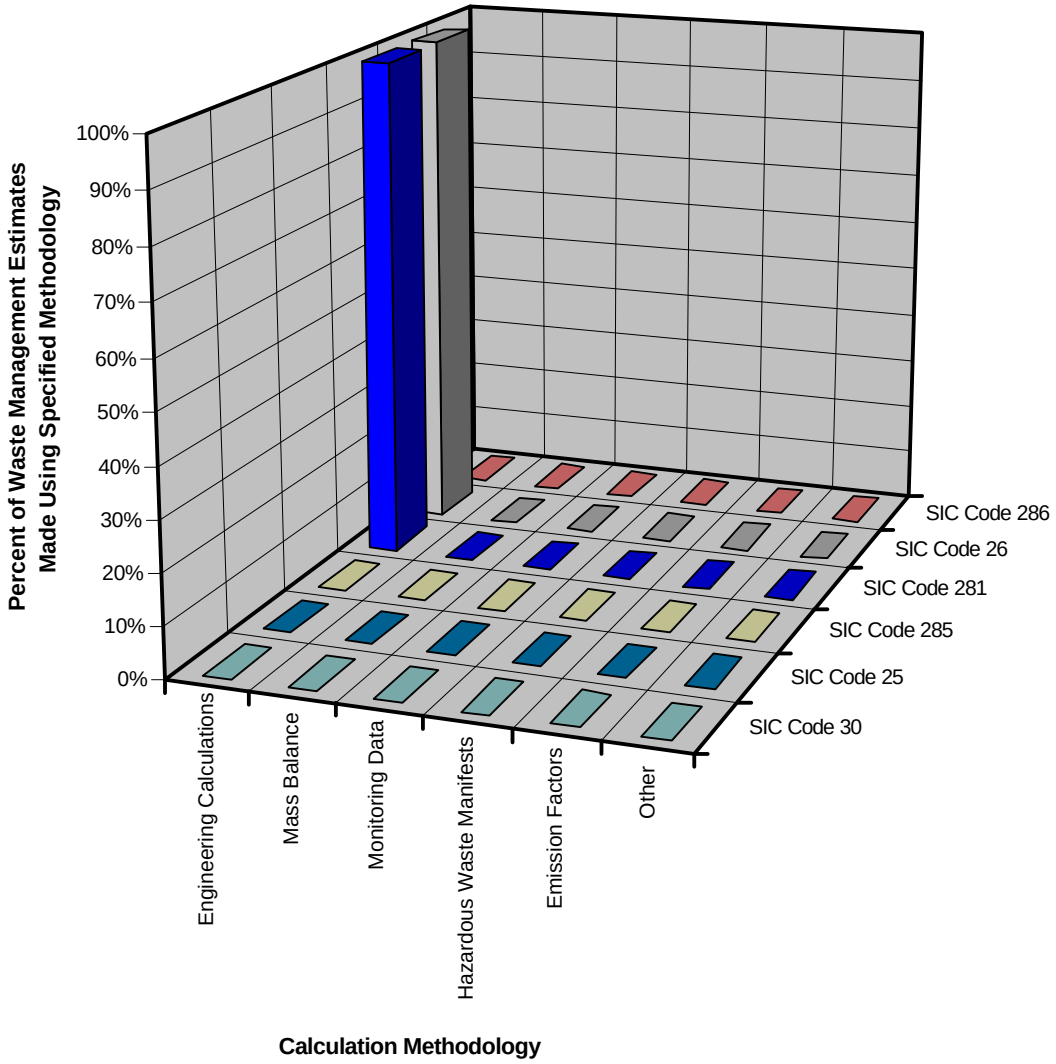
Data for this figure can be found on Table 4-4.

Figure 4-4c. Distribution of Calculation Methodologies (Receiving Stream)
RY 1994 and RY 1995



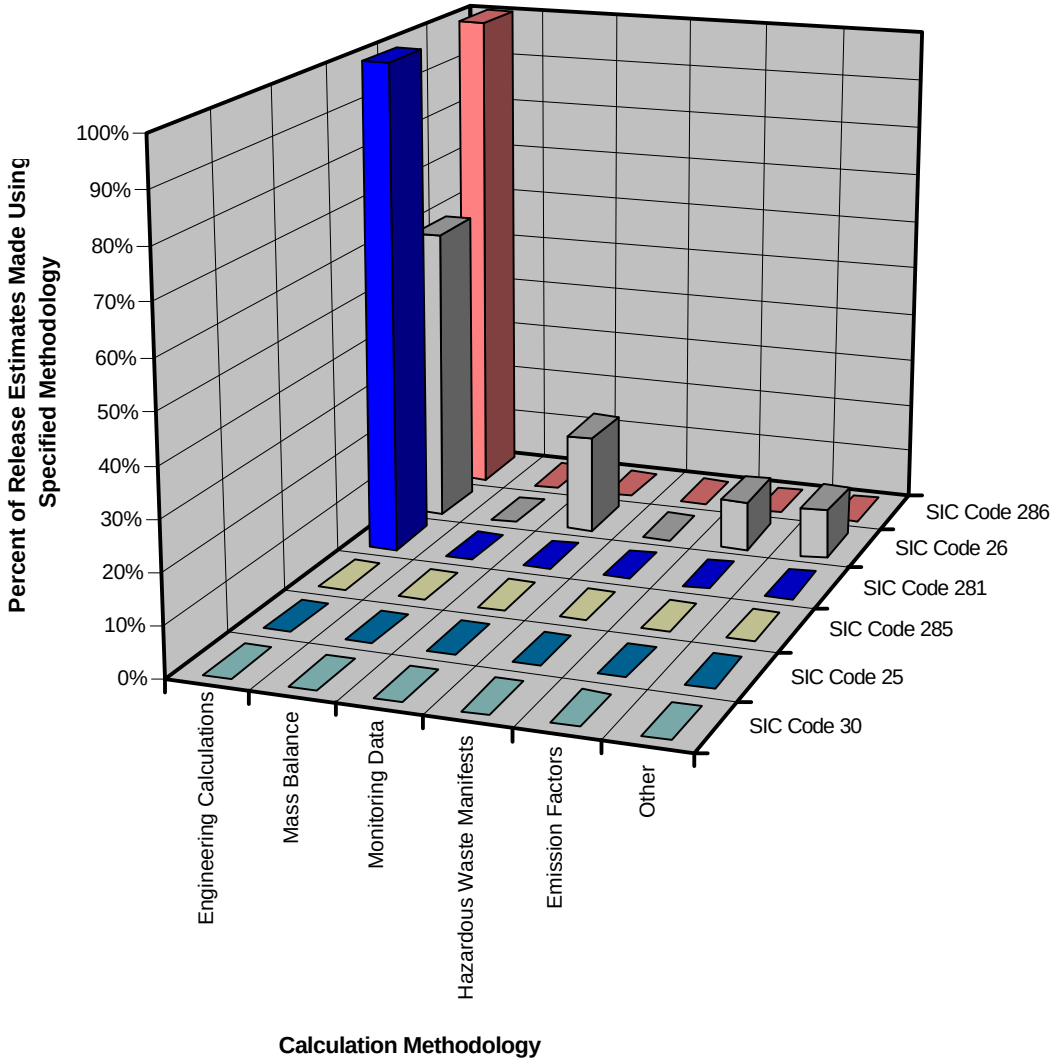
Data for this figure can be found on Table 4-4.

Figure 4-4d. Distribution of Calculation Methodologies (Underground Injection)
RY 1994 and RY 1995



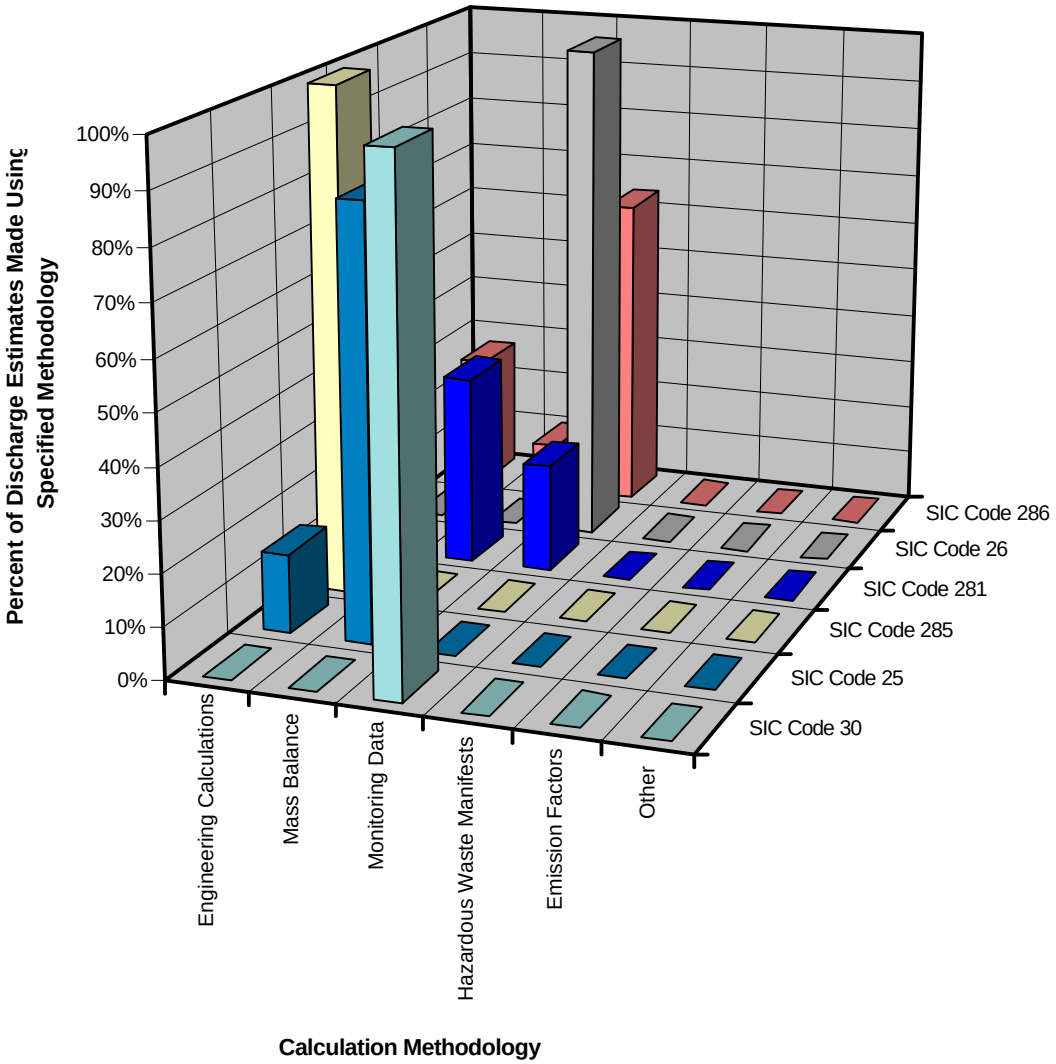
Data for this figure can be found on Table 4-4.

Figure 4-4e. Distribution of Calculation Methodologies (Land On-Site)
RY 1994 and RY 1995



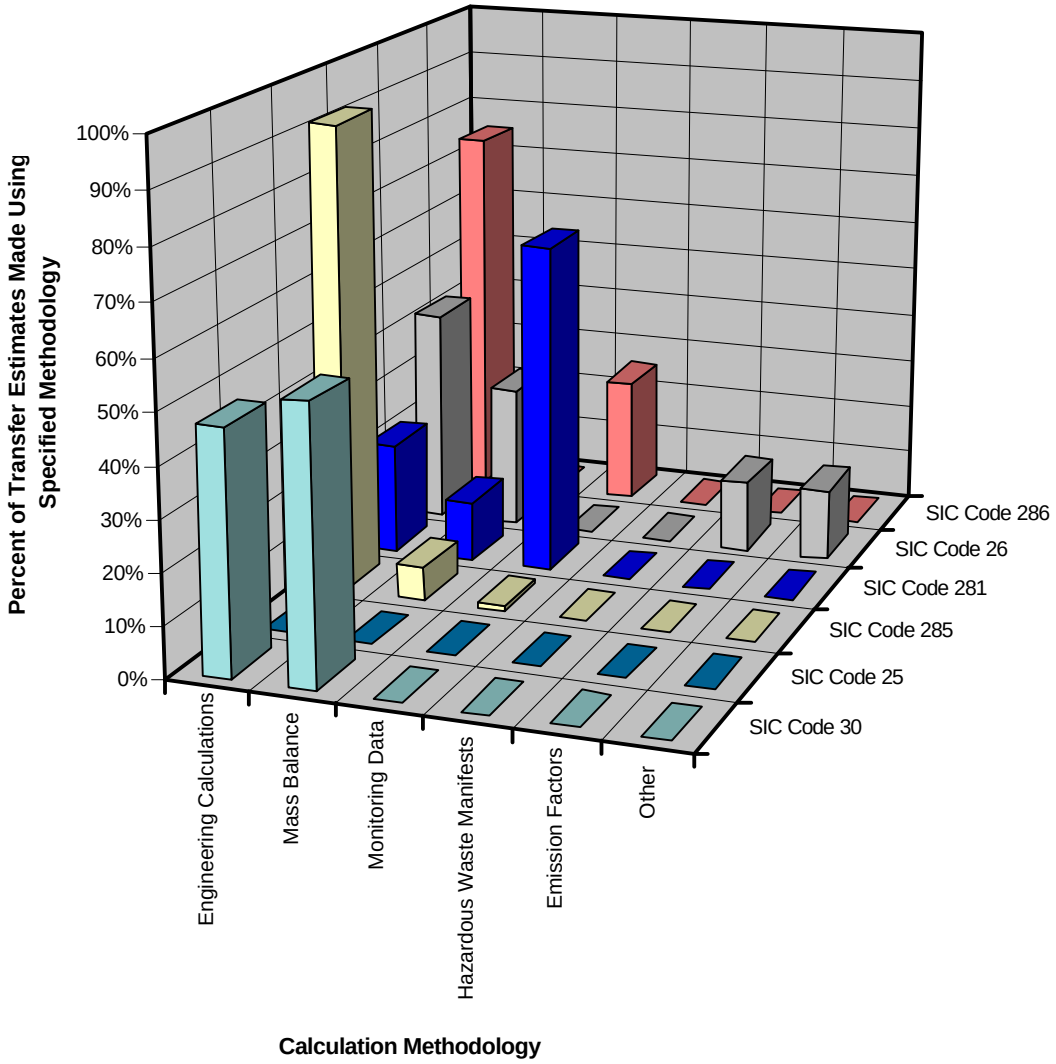
Data for this figure can be found on Table 4-4.

Figure 4-4f. Distribution of Calculation Methodologies (POTW)
RY 1994 and RY 1995



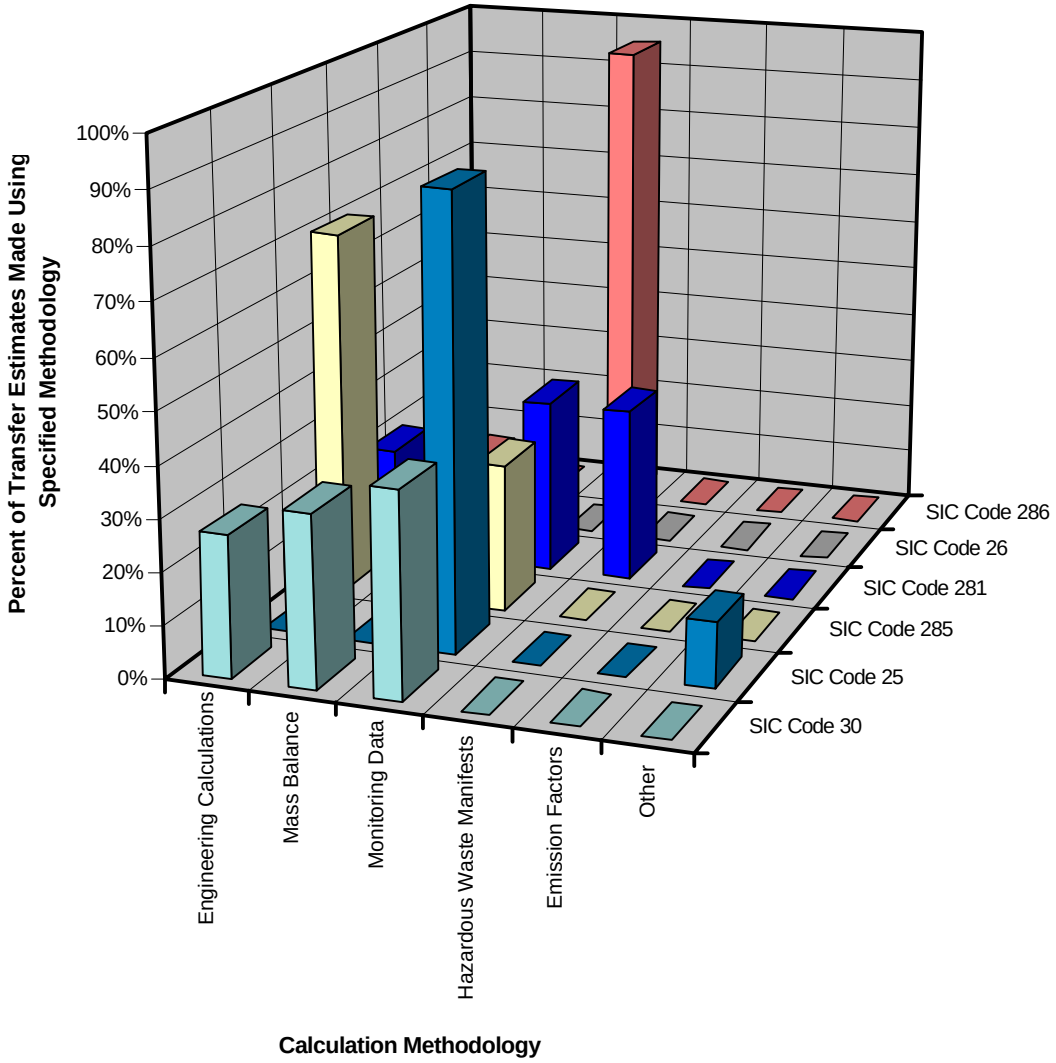
Data for this figure can be found on Table 4-4.

Figure 4-4g. Distribution of Calculation Methodologies (To Off-Site Disposal)
RY 1994 and RY 1995



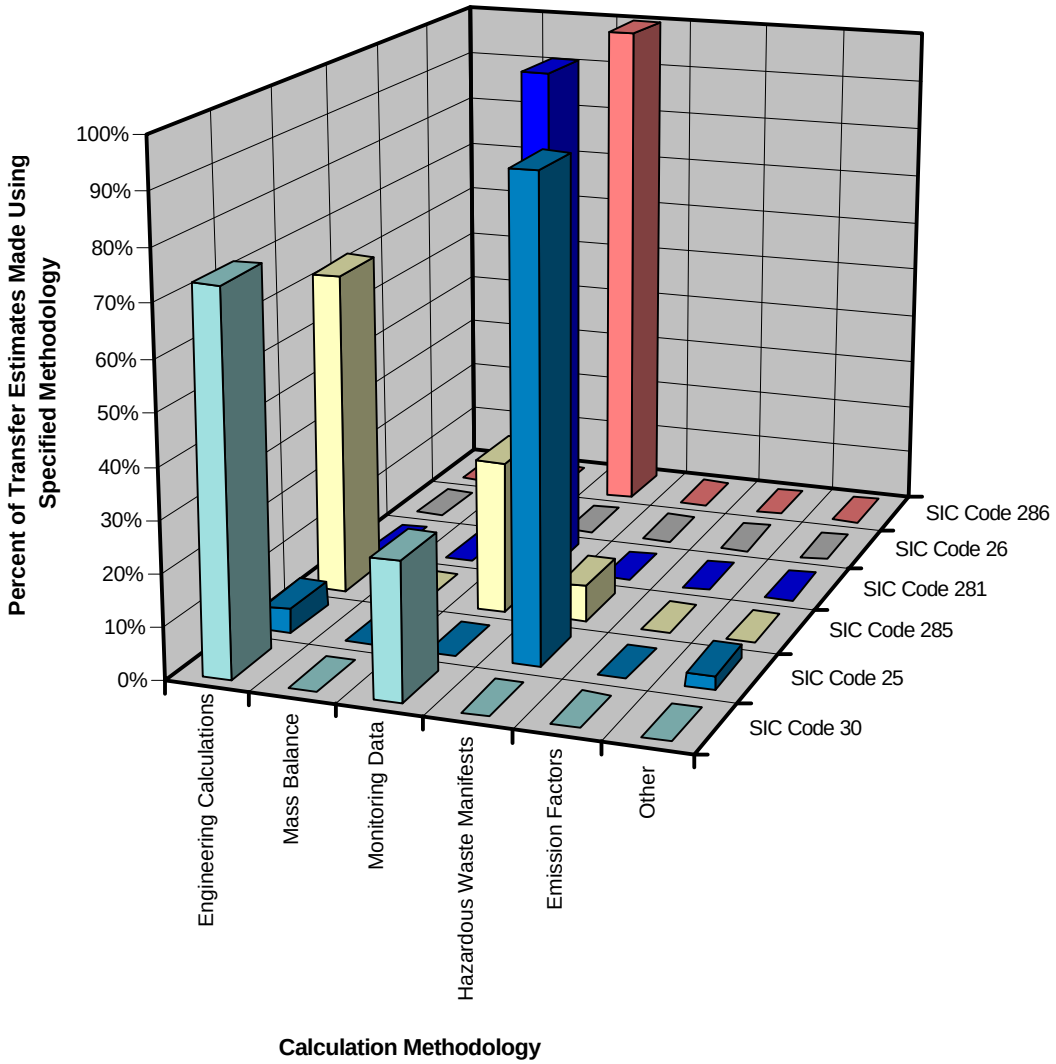
Data for this figure can be found on Table 4-4.

Figure 4-4h. Distribution of Calculation Methodologies (To Off-Site Treatment)
RY 1994 and RY 1995



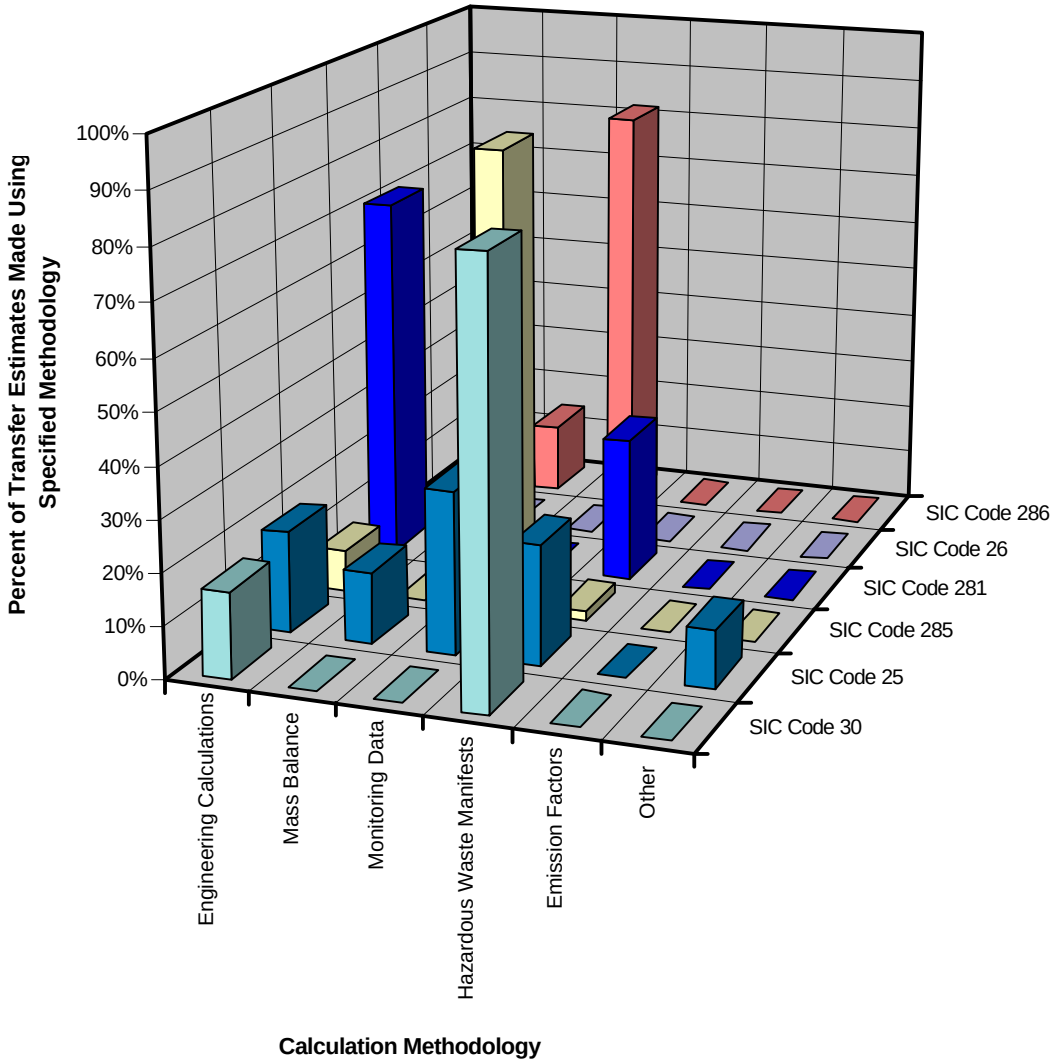
Data for this figure can be found on Table 4-4.

Figure 4-4i. Distribution of Calculation Methodologies (To Off-Site Recycle)
RY 1994 and RY 1995



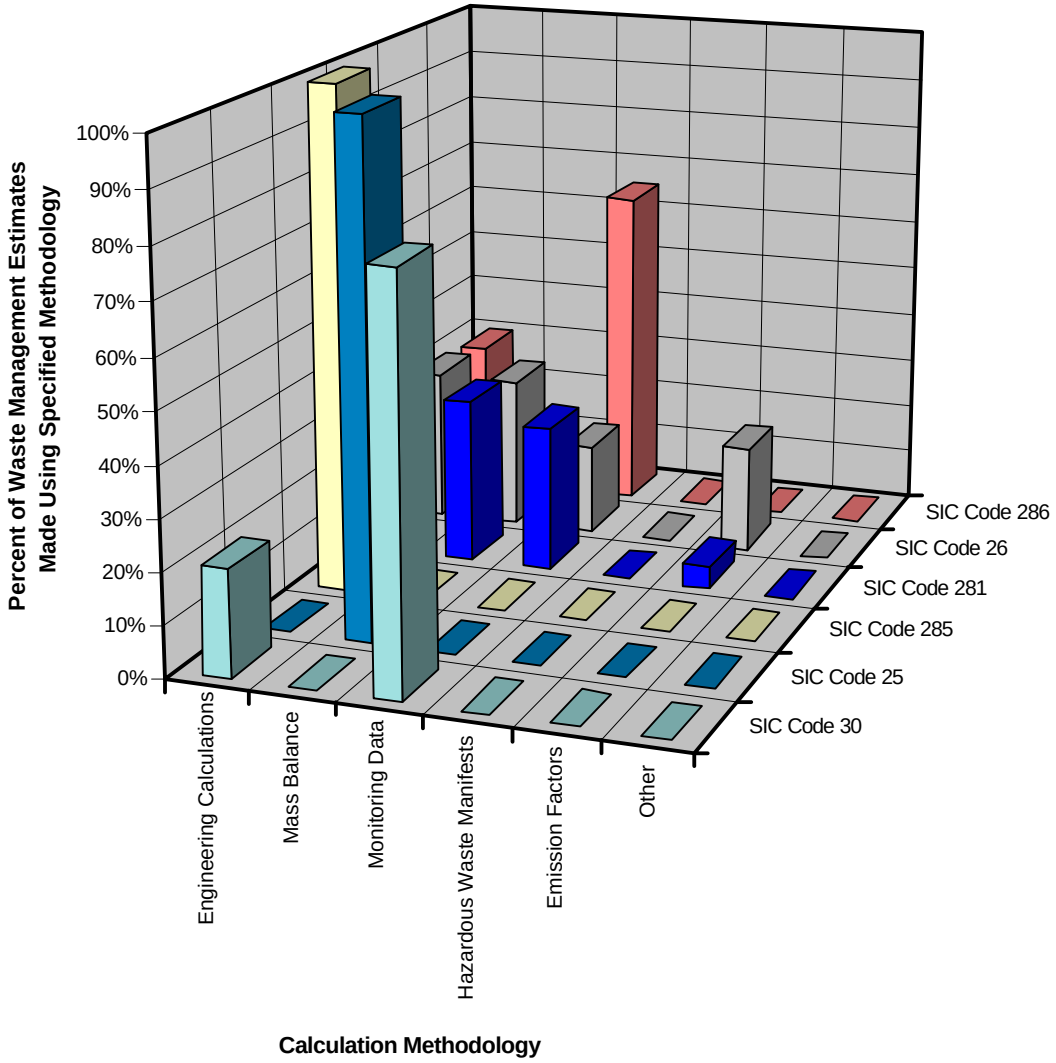
Data for this figure can be found on Table 4-4.

Figure 4-4j. Distribution of Calculation Methodologies (To Off-Site Energy Recovery)
RY 1994 and RY 1995



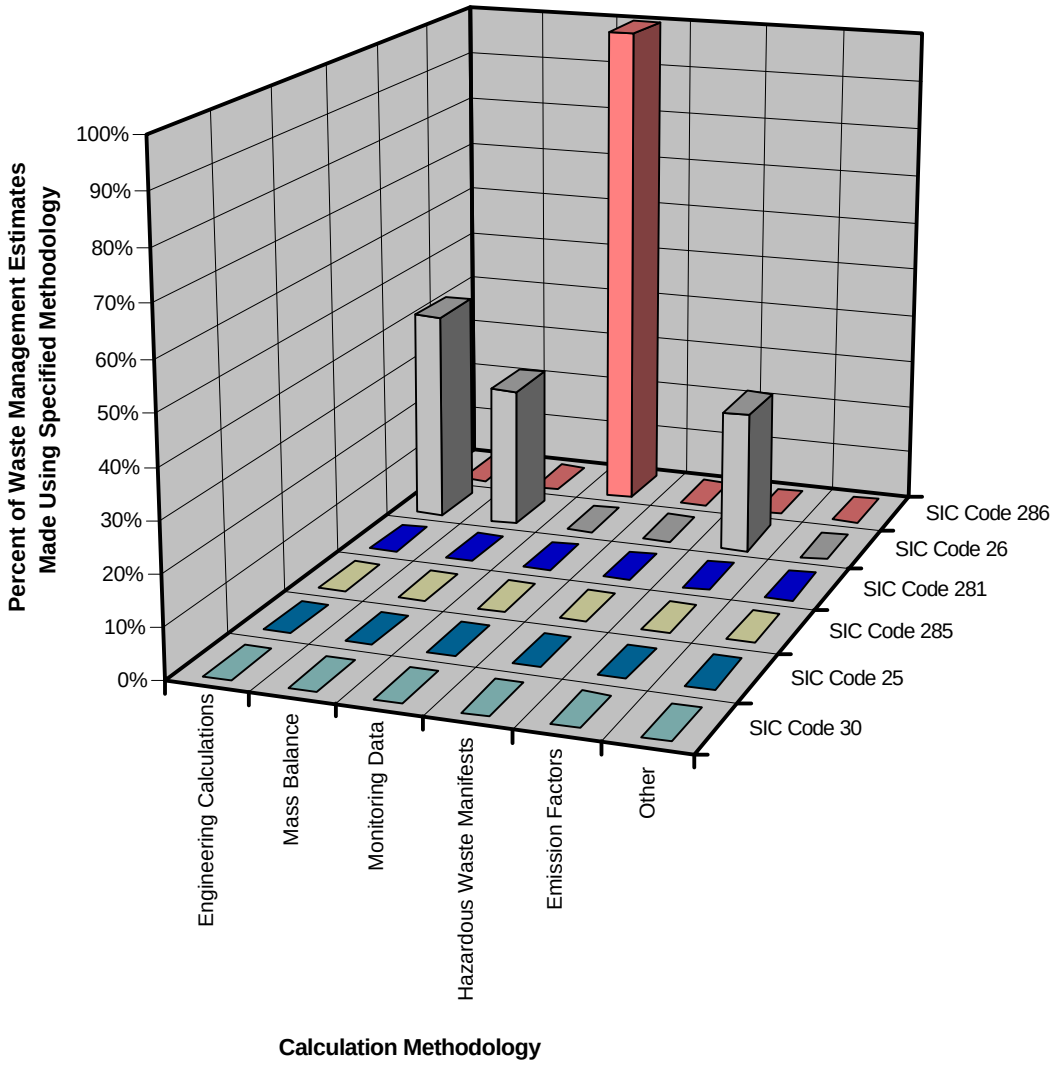
Data for this figure can be found on Table 4-4.

Figure 4-4k. Distribution of Calculation Methodologies (To On-Site Treatment)
RY 1994 and RY 1995



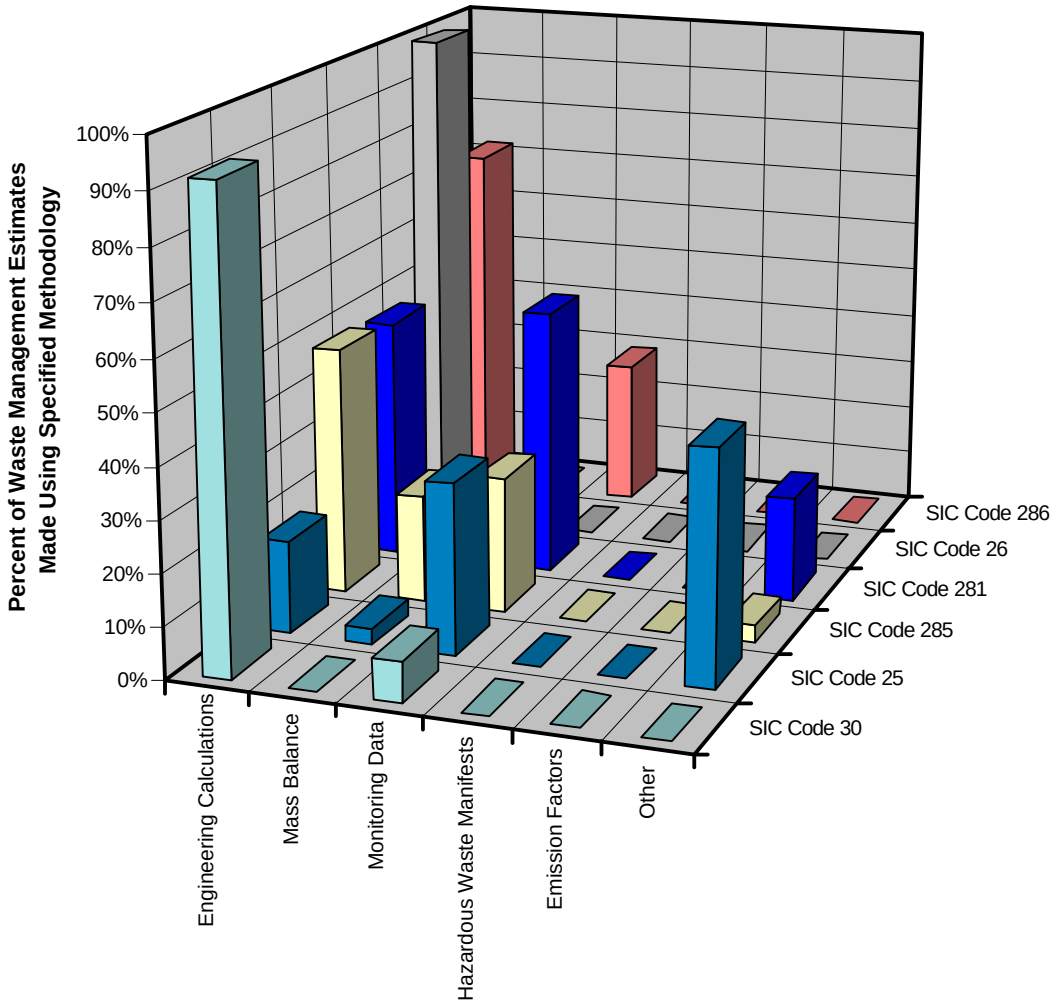
Data for this figure can be found on Table 4-4.

Figure 4-4l. Distribution of Calculation Methodologies (To On-Site Energy Recovery)
RY 1994 and RY 1995



Data for this figure can be found on Table 4-4.

Figure 4-4m. Distribution of Calculation Methodologies (To On-Site Recycling)
RY 1994 and RY 1995



Data for this figure can be found on Table 4-4.

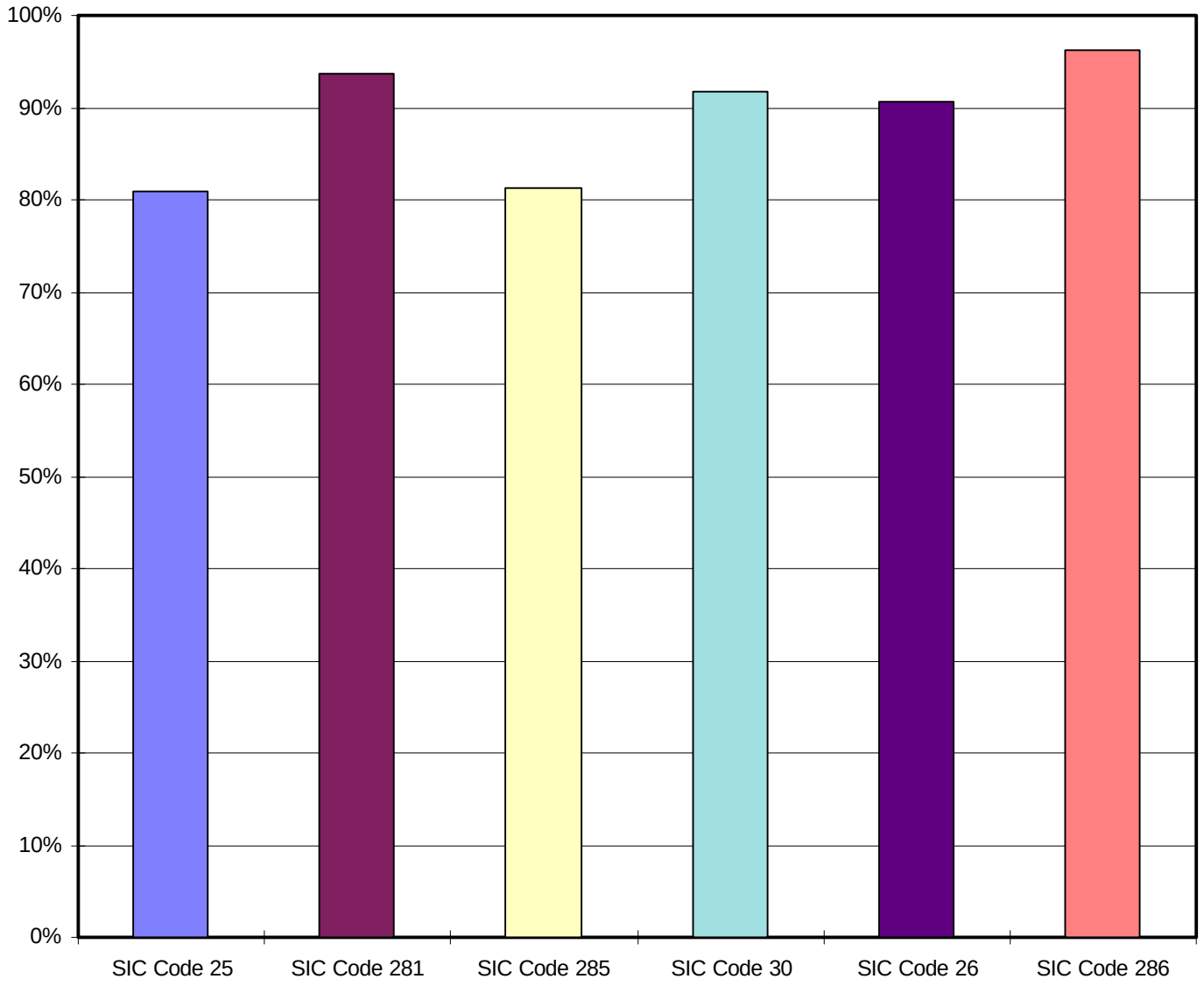
and emission factors have been presented in Table 4-4 only when they were the predominant method used.

It was uncommon for facilities to have access to monitoring data for fugitive releases. However, it was used when available (typically in the form of periodic leak tests). Emission factors were used by several facilities (except in SIC Code 25). The type of emission factors used and a subsequent discussion is presented below. Mass balances were also used by many facilities to determine fugitive releases from at least one process line or unit operation when a material balance around the entire facility resulted in a quantity of chemical that was unaccounted for.

Most facilities reported a stack release. Although facilities had difficulty in estimating these releases, they typically indicated less difficulty in identifying and quantifying these releases than observed with fugitives. Engineering calculations and mass balances were the most often used methods. However, the use of emission factors (including emission factors for releases from storage tanks and facility-derived factors for releases from stacks) and monitoring data (actual releases from stack tests) were often observed. Facilities with sophisticated monitoring equipment associated with large stack emissions, such as chemical manufacturers and pulp and paper mills, were more likely to use monitoring data and/or associated emission factors than smaller facilities, such as paint manufacturers which typically used mass balances or engineering judgement.

Table 4-4 and the corresponding figures also show that most facilities used monitoring data and/or hazardous waste manifests in conjunction with engineering calculations to estimate transfers off-site for further waste management. There were two main sources of these data. One was from periodic facility sampling of the waste that was collected prior to shipment. The second was from sampling conducted by the receiving facility. Documentation for this data was typically more prevalent and more complete (and therefore, presumably more accurate) than methods used to estimate releases to most other sources.

Figure 4-5. Frequency the Facility Used the Best Methodology to Estimate Releases and Other Waste Management Activities



Some facilities reported discharges to POTWs and/or receiving streams (predominantly organic chemical manufacturer and pulp and paper mills, which have large water releases). A mass balance and/or engineering judgement were the primary methods used for POTW discharges. Facilities typically used a mass balance around the entire facility to determine the quantity of EPCRA Section 313 chemical that could not be accounted for. Then, engineering judgement (usually based on knowledge of chemical volatility and solubility) was used to estimate a partition factor between releases of the unaccounted quantity that would be lost to fugitive air vs. that sent to a POTW. This method was also used to determine discharges to receiving streams, when applicable. However, discharges to receiving streams were often monitored for compliance with various local, state, or other federal regulations, resulting in a more accurate estimate.

Figure 4-5 presents the frequency that site surveyors felt the method used by the facility would result in the most accurate estimate of release or other waste management quantity based on information and data available to the surveyor at the time of the site visit. It does not present the frequency that the facility correctly calculated the quantity of release or other waste management activity. This figure shows concurrence with the selected method in most cases. It should be noted that during many visits the surveyor identified another, more accurate method that could have been used to estimate releases and other waste management quantities, if a particular variable had been tracked for the reporting year. In many cases, the facility contact indicated that it would have been fairly easy for the facility to implement the suggestion and that they planned to take the surveyors advice for subsequent years. However, there was no way to recreate the required variable for the reporting year(s) surveyed. Another limitation to this analysis is the fact that surveyors often identified a more accurate method that could be used based on data the facility claimed to have. However, the facility stated that they could not gather the information in a reasonable time period for use by the site surveyor.

Emission factors were frequently used to estimate fugitive and stack releases. EPA instructed site surveyors to determine the type of emission factors used, when applicable. The potential types were designated as facility-derived, EPA-approved or published, trade

Table 4-5

Types of Emission Factors Used for Fugitive and Stack Releases
RY 1994 and RY 1995

Release and Other Waste Management Activity Type	Release and Other Waste Management Activity Source	Percent (weighted by chemical)					
		SIC Code 25	SIC Code 281	SIC Code 285	SIC Code 30	SIC Code 26	SIC Code 286
Fugitive	Facility Derived	93.9%	26.9%	38.7%	35.3%	5.0%	13.9%
	EPA Derived	0.0%	8.4%	61.3%	27.6%	0.0%	41.7%
	Trade Association Derived	0.0%	51.8%	0.0%	37.1%	90.0%	36.1%
	Other	6.1%	12.9%	0.0%	0.0%	5.0%	8.3%
	TOTAL:	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Stack	Facility Derived	0.0%	53.2%	82.7%	81.9%	10.7%	33.3%
	EPA Derived	61.6%	38.4%	17.3%	12.9%	3.6%	56.7%
	Trade Association Derived	0.0%	0.0%	0.0%	5.2%	85.7%	10.0%
	Other	38.4%	8.4%	0.0%	0.0%	0.0%	0.0%
	TOTAL:	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Figure 4-6a. Type of Emission Factors Used (Fugitive)
RY 1994 and RY 1995

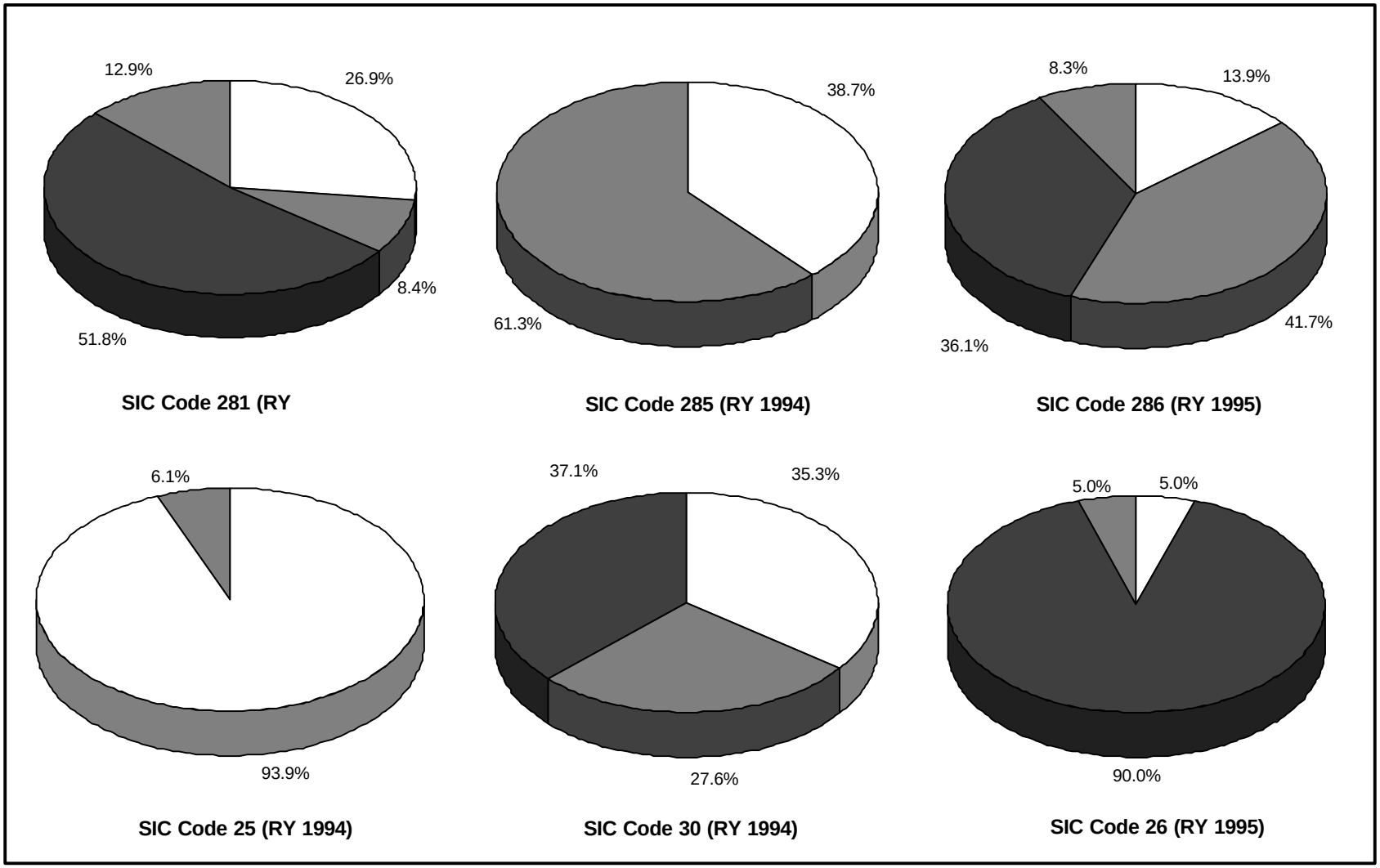
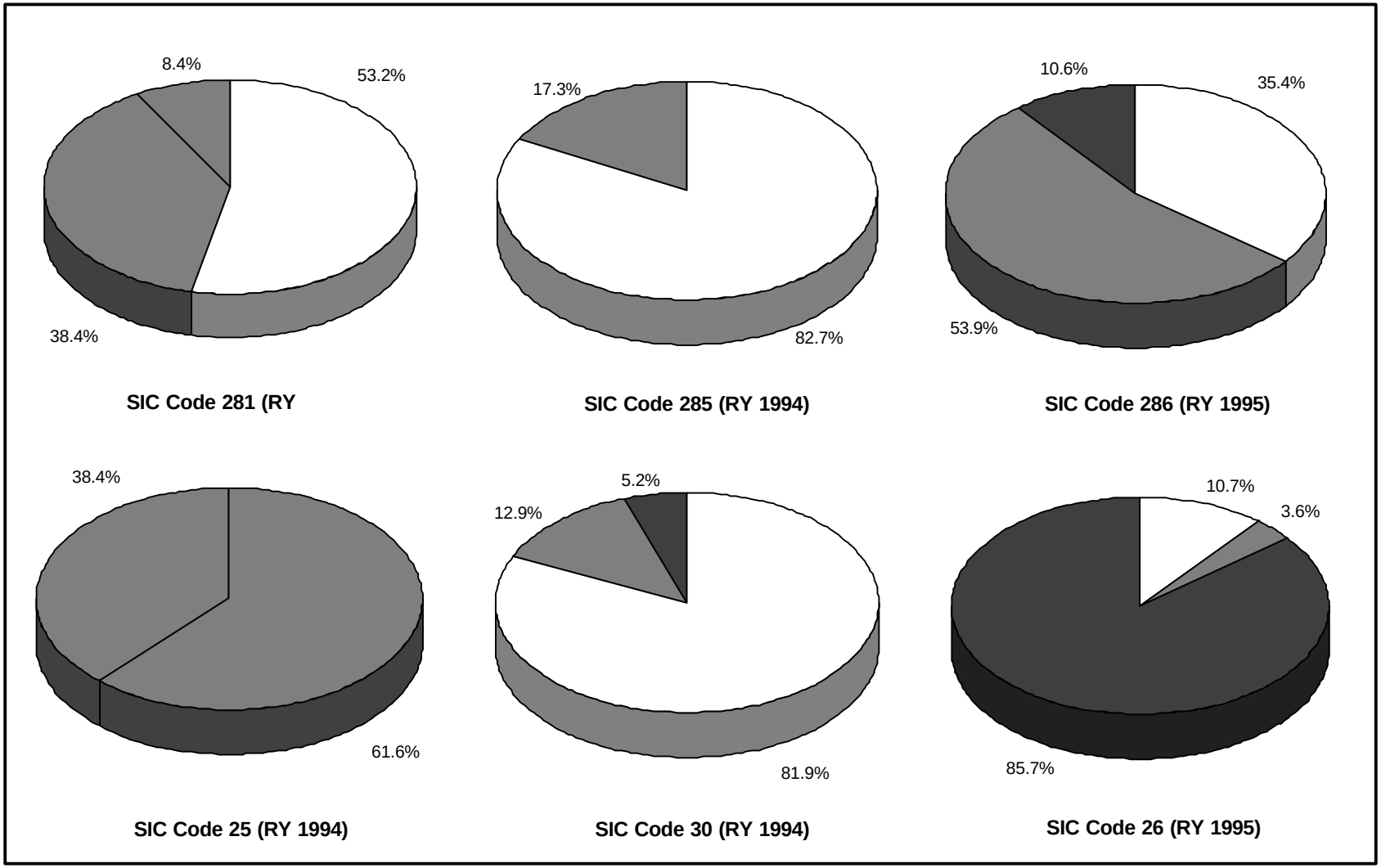


Figure 4-6b. Type of Emission Factors Used (Stack)
RY 1994 and RY 1995



association-derived, and other. Table 4-5 and Figures 4-6a and 4-6b present the percentage of use for each type of emission factor (weighted).

These factors were typically employed to estimate fugitive releases of volatile chemicals from process areas (open mix tanks or vats) or piping (leaks from pumps, valves, flanges, etc.) or to estimate stack releases from storage tanks and stack releases from gasses generated by unit operations that were channeled through stacks (typically stacks from various air pollution control devices).

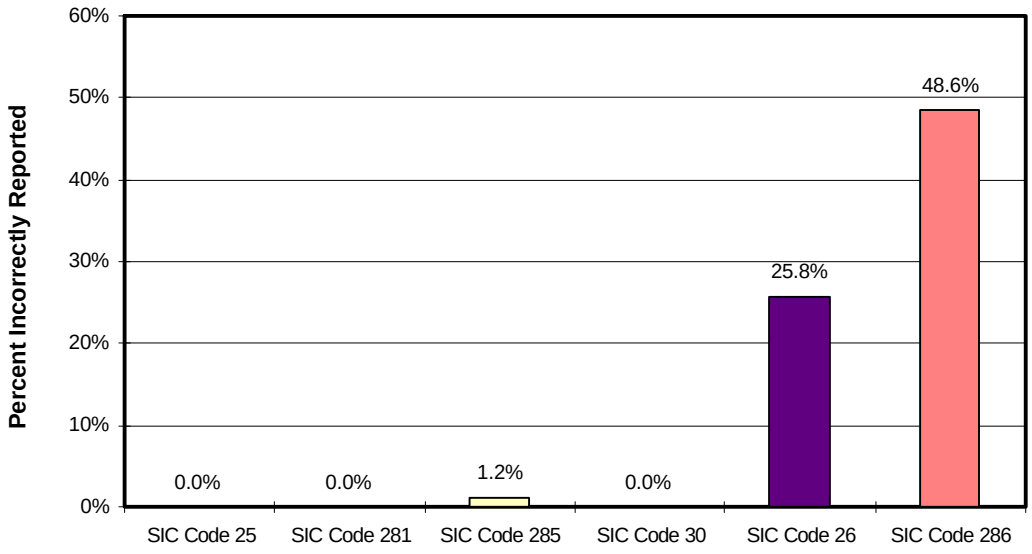
4.5 On-Site Waste Management Activities (recycling, treatment, and energy recovery)

Quantities of the toxic chemicals in waste managed by on-site waste management activities (recycling, treatment, and energy recovery) were rarely observed during the site visits. Table 4-2 and Figure 4-2 show that a considerable number of facilities in SIC Codes 26 and 286 incorrectly identified these releases. It should be noted that there may be considerable uncertainty in the quantitative values presented because most facilities were confused by the definition of "recycling". EPA recognized, before the RY 1994 and RY 1995 site surveys were initiated, that this potential might exist and instructed site surveyors only to analyze releases to recycling activities if the facility reported them. Therefore, site surveyors only recorded on-site waste management activities as incorrect if such activities were claimed but did not exist. Facilities typically correctly identified on-site treatment activities when they existed. However, there was considerable confusion and error when the releases and other waste management activities were quantified for Section 8 of the Form R.

Additionally, for the site visits completed through May 1997 (those pertaining to RY94) EPA only asked site surveyors to compile the data for source reduction and on-site recycling. Site surveyors were not requested to investigate these issues further or discuss them with the facility contacts. Therefore, specific, quantitative input from these visits cannot be provided, other than raw data based on what was reported by each facility.

Additionally, EPA was concerned that facilities may incorrectly report the quantity of EPCRA Section 313 Chemicals to on-site treatment in Section 8 of the Form R due to potential confusion between requirements for Section 7 and Section 8. Site surveyors specifically determined whether the quantities reported were quantities sent to treatment or quantities actually treated. Figure 4-7 presents the weighted percent of facilities that incorrectly reported the quantity sent to treatment rather than that actually treated. A significant number of facilities in SIC Codes 26 and 286 incorrectly reported this quantity (25.8% and 48.6%, respectively) while only one facility incorrectly reported from SIC Code 281 (representing 1.2%) and no facilities from SIC Codes 25, 30, or 281 incorrectly reported.

Figure 4-7. Facilities Incorrectly Reporting the Quantity sent to Treatment Rather than that Actually Treated (Weighted)



It was observed that many facilities in the organic chemical and the paper manufacturing SIC Codes, 286 and 26, respectively, had large on-site wastewater treatment plants. Several EPCRA Section 313 chemicals (such as ammonia, sulfuric acid, and chlorine) were used in the treatment process. Several facilities incorrectly reported that these chemicals were treated themselves because they were destroyed during the treatment process. EPCRA Section 313 chemicals added to waste treatment units are not considered to be treated themselves. This situation was never observed at facilities in SIC Codes 25, 281, 285, or 30 because these facilities did not typically have on-site wastewater treatment plants or the quantity of treatment chemical used was below the threshold.

EPA requested site surveyors to discuss source reduction and on-site recycling issues and acquire feedback from facility contacts during visits to SIC Codes 26 and 286 (those pertaining to RY 1995).

The following points were raised by facility contacts during the 20 visits to Paper and/or Organic Chemical facilities for RY 1995.

- Facilities tend to only claim source reduction or recycling if they implement a procedure for the specific purpose of reducing releases. Often a facility implements one or more of the items that EPA considers source reduction, but they do not bother to go through the entire list to see if they can claim it. For example, a facility may change their raw material transfer operations due to a management decision. This change may result in source reduction as a side effect, but the facility does not claim it because the purpose was not source reduction.

- Facilities often do not claim source reduction or recycling activities due to what they consider to be a lack of detailed definitions. For example, facilities believe that many of the codes and corresponding descriptions are vague and they do not feel comfortable claiming an activity without better guidance.

- Facilities have stated that they would rather be conservative and only claim a source reduction or recycling activity if they can verify and document it. For example, some categories such as "better management practices" are vague and facilities do not claim it because they do not know how to verify it.

- Some trade associations instruct their members not to claim a source reduction activity unless they can document a corresponding reduction in releases - even if the facility specifically installs a unit or practice that is intended to serve as recovery or recycling.

- Facilities have stated that there are so many codes that they do not bother to analyze each code every year to see if any changes in their processes apply.

Tables 4-6 through 4-11 summarize data that was collected for on-site recycling that was observed during site visits pertaining to RY 1994 and RY 1995. Table 4-11 presents the frequency that each chemical was recycled, as reported by these facilities.

Table 4-6

Observed On-Site Recycling Activities
(SIC Code 281)

# Of Facilities Reporting	Type of Recycling Claimed	Description of Recycling Stream
1	Cleaning Waste	Not Specified
1	Spent Process Solvent	Not Specified
1	Other	Scrubber Water
2	Other	Dust Collector Waste
3	Other	Off-Spec. Product
1	Other	Ion Exchange Waste
1	Other	Vapor Recovery Unit

Table 4-7

Observed On-Site Recycling Activities
(SIC Code 285)

# Of Facilities Reporting	Type of Recycling Claimed	Description of Recycling Stream
5	Cleaning Waste	Not Specified
5	Spent Process Solvent	Not Specified

Table 4-8

Observed On-Site Recycling Activities
(SIC Code 25)

# Of Facilities Reporting	Type of Recycling Claimed	Description of Recycling Stream
1	Spent Process Solvent	Distillation Unit
1	Spent Process Solvent	Not Specified
1	Spent Process Solvent	Batch Still and Thin-Film Evaporation
1	Other (obsolete material)	Batch Still
1	Cleaning Waste	Not Specified
1	Cleaning Waste	Batch Still and Thin-Film Evaporation

Table 4-9

Observed On-Site Recycling Activities
(SIC Code 30)

# Of Facilities Reporting	Type of Recycling Claimed	Description of Recycling Stream
1	Spent Process Solvent	Not Specified
1	Other	Resin from waste plastic
1	Other (off-spec product)	Reuse in subsequent batch

Table 4-10

Observed On-Site Recycling Activities
(SIC Code 286)

# Of Facilities Reporting	Type of Recycling Claimed	Description of Recycling Stream
1	Not specified	Removed Stack Emissions
4	Spent Process Solvent	Not Specified
1	Other	Scrubber Water
3	Other (unreacted raw materials)	Process Waste (off-spec product)

Table 4-11

Chemicals For Which Recycling Was Claimed
(SIC Codes 281, 285, 25, 30, and 286 Combined)

CHEMICAL	# OF FACILITIES REPORTING
Xylene	7
Toluene	5
Methanol	3
MIBK	3
1,3-Butadiene	2
Ammonia	2
Ethylbenzene	2
Ethylene glycol	2
Glycol ehters	2
2-ethoxyethanol	1
4,4'-isopropylidenediphenol	1
Ammonium Nitrate	1
Aniline	1
Chlorine	1
Copper Compounds	1
Cyanide Compounds	1
Di-(2-ethylhexyl)Phthalate	1
Dichloromethane	1
Freon	1
HCl	1
Mercury	1
N-butyl alcohol	1
N-butyl alcohol	1
Nitric Acid	1
N-N-Dimethylaniline	1
Phosphoric Acid	1